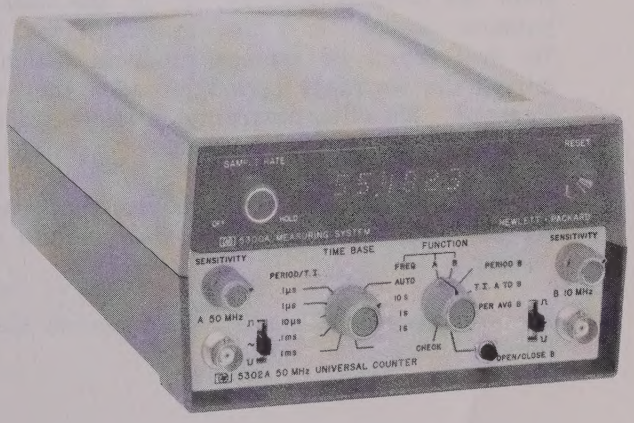
OPERATING AND SERVICE MANUAL

UNIVERSAL COUNTER

5302A



90007

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.

MODEL NUMBER: **5302A**
UNIVERSAL COUNTER

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SECTION IX B
UNIVERSAL COUNTER
5302A

SERIAL PREFIX 1112A

This Section applies directly to HP Model 5302A, Universal Counters having serial prefix number 1112A, and must be inserted into the 5300A Measuring System Manual.

NEWER INSTRUMENTS

This Section with enclosed "Manual Changes Sheet(s)" applied directly to HP Model 5302A Universal Counters having prefix numbers above 1112A.

OLDER INSTRUMENTS

Changes required to back-date this Section for older instruments are in Section IX B, Subsection VII.

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Printed: JULY 1973

HP PART NO.
MANUAL: 05302-90007

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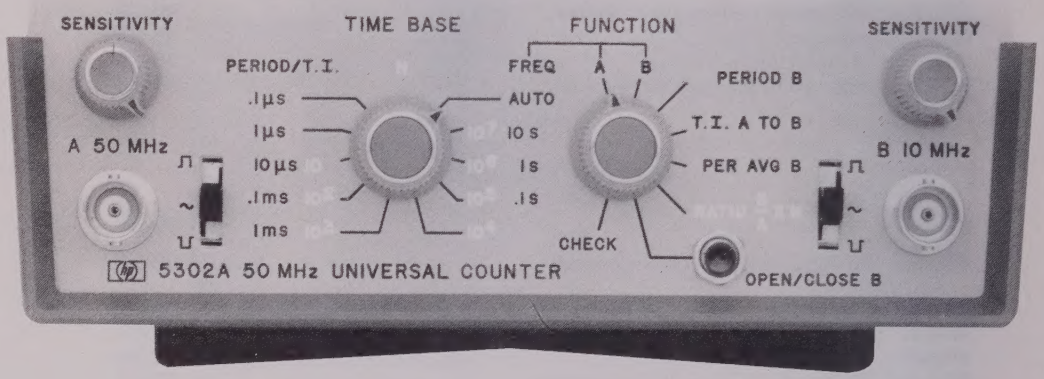
Figure 9B-1-1. Model 5302A Universal Counter



SECTION IX B
5302A UNIVERSAL COUNTER
SUBSECTION I
GENERAL INFORMATION

9B-1-1. INTRODUCTION

9B-1-2. Description

9B-1-3. The Hewlett-Packard Model 5302A Universal Counter, when plugged onto an HP Model 5300A Measuring System, is capable of: Measuring frequencies up to 50 MHz, Time Interval measurements from 500 nsecs to 1000 seconds, Period and Period Average over a range of 10 Hz to 1 MHz, Ratio of two Frequencies and Totalizing. The electrical and mechanical specifications are listed in Table 9B-1-1.

9B-1-4. Purpose and Use of Section IX B

9B-1-5. Section IX B contains the documentation necessary to operate, maintain, and repair the HP Model 5302A Universal Counter plug-on. Also included are parts lists, component locators, and schematics. This information is intended to be inserted into the 5300A Measuring System manual as part of Section IX of that manual.

9B-1-6. INSTRUMENT IDENTIFICATION

9B-1-7. Hewlett-Packard uses a two-section, nine-digit serial number (0000A00000) mounted on the rear panel to identify the instrument. The first four digits are the serial prefix and the last five digits refer to the specific instrument. If the serial prefix on your instrument differs from that listed on the title page of this section, there are differences between the manual and your instrument. Lower serial prefixes are documented in Section IX B, Subsection VII and higher serial prefixes are covered by a manual change sheet included with the manual.

9B-1-8. Manual Changes and Options

9B-1-9. The title page lists the serial prefix number to which this information directly applies. If the serial prefix is different from the one listed, a change sheet is included describing the required changes. If this change sheet is missing, the information can be supplied by any Hewlett-Packard Sales and Service office listed in Section VI of the 5300A Measuring System manual. Options are listed in Section IX B, Subsection VII.

Table 9B-1-1. 5302A Universal Counter Specifications

INPUT CHANNELS A AND B

RANGE: Channel A: 10 Hz to 50 MHz.
Channel B: 10 Hz to 10 MHz.

SENSITIVITY (min): 25 mV rms sine wave 50 Hz to to 1 MHz.
50 mV rms sine wave 10 Hz to 10 MHz.
100 mV rms sine wave at 50 MHz.
150 mV p-p pulse at 50 nsec minimum pulse width.
Sensitivity can be varied up to 2.5 V rms by adjusting the SENSITIVITY control.

IMPEDANCE: 1 MΩ shunted by less than 30 pF.

OVERLOAD PROTECTION: 500 V (dc + peak ac)
250 V rms, dc to 400 Hz.
10 V rms above 10 MHz.

TRIGGER LEVEL: Selectable positive, negative, or zero V for optimum triggering from sinusoidal inputs or pulses.

SLOPE: Automatically switched to trigger on leading edge of pulse. Positive slope for sinusoidal inputs.

GATE OUT: Rear panel BNC. TTL low level while gate is open.

FREQUENCY

RANGE: Channel A: 10 Hz to 50 MHz. Prescaled by 10.
Channel B: 10 Hz to 10 MHz.

GATES TIMES: Manually selected 0.1, 1 or 10 seconds. AUTO position automatically selects gate time to fill display for maximum resolution within 1-second measurement time.

ACCURACY: ±1 count ± time base accuracy.

DISPLAY: Hz, kHz, and MHz with positioned decimal point.

TIME INTERVAL

RANGE: 500 nsec to 1000 seconds.

INPUT: Channels A and B.

RESOLUTION: 100 nsec to 1 msec in decade steps.

ACCURACY: ±1 count ± time base accuracy ± trigger error. *

DISPLAY: μs, ms, or S (seconds) with positioned decimal point.

PERIOD

RANGE: 10 Hz to 1 MHz.

INPUT: Channel B.

RESOLUTION: 100 nsec to 1 msec in decade steps.

ACCURACY: ±1 count ± time base accuracy ± trigger error. **

DISPLAY: μs, ms, or S (seconds) with positioned decimal point.

PERIOD AVERAGE

RANGE: 10 Hz to 1 MHz.

INPUT: Channel B.

PERIODS AVERAGE: 1 to 10^3 automatically selected for maximum resolution.

RATIO

DISPLAY: F_B/F_A times multiplier (N).

N = 10 to 10^7, selectable in decade steps.

RANGE: Channel A: 10 Hz to 1.0 MHz.
Channel B: 10 Hz to 10 MHz.

ACCURACY: ±1 count of F_B ± trigger error of F_A. *

OPEN/CLOSE (Totalizing)

RANGE: 10 MHz maximum.

INPUT: Channel B.

FUNCTION: Input signal totalized while gate is open. Opening and closing of gate initiated by front panel pushbutton switch.

GENERAL

CHECK: Counts internal 10 MHz reference frequency.

OPERATING TEMPERATURE: 0° to 50°C.

POWER REQUIREMENTS: Including 5300A mainframe, nominally 10 watts.

WEIGHT: Net, 2 lbs. (0.9 kg). Shipping, 3 to 14 lbs. (1.5 kg).

*For any waveshape, trigger error is less than

$$\pm \frac{0.0025}{\text{Signal Slope } (V/\mu s)\ \mu s}$$

**Trigger error is less than ±0.3% of one period periods average for signals with 40 dB or better signal-to-noise ratio and minimum amplitude. Decreases with increased signal amplitude and slope.

SECTION IX B
5302A UNIVERSAL COUNTER
SUBSECTION II
INSTALLATION

9B-2-1. UNPACKING AND INSPECTION

9B-2-2. If the shipping carton is damaged ask that the carrier's agent be present when the instrument is unpacked. Inspect the instruments for damage such as scratches, dents, broken knobs, etc. If the instrument is damaged or fails to meet performance tests when used with the 5300A Measuring System notify the carrier and the nearest Hewlett-Packard Sales and Service office immediately. Performance check procedures are located in Section IX, B-5, and Sales and Service offices are listed in Section VI of the 5300A portion of the manual. Retain the shipping carton and the padding material for the carrier's inspection. The Sales and Service office will arrange for the repair or replacement of the instrument without waiting for the claim against the carrier to be settled.

9B-2-3. STORAGE AND SHIPMENT

9B-2-4. PACKAGING. To protect valuable electronic equipment during storage or shipment, always use the best packaging methods available. Your Hewlett-Packard Sales and Service office can provide packaging material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here is one recommended packaging method:

a. The original container is a corrugated cardboard box with 200 lbs. burst test (HP No. 9211-1620). The instrument is secured and protected, while in the box by a top and bottom molded frame of polystyrene foam (HP No. 9220-1545). Also included with the instrument is a plastic dust-protection cover HP Part No. 05300-80004.

9B-2-5. INSTALLATION AND REMOVAL OF PLUG-ON

9B-2-6. The 5302A Universal Counter must be used with a mating 5300A Measuring System before any measurements can be made. To mate the 5302A Universal Counter with the 5300A Measuring System, see Figure 2-1 and Paragraph 2-11 of the 5300A portion of the manual.

9B-2-7. ENVIRONMENT. Conditions during storage and shipment should be normally limited as follows:

a. Maximum altitude: 25,000 feet.

b. Minimum temperature: -40°F (-40°C).

c. Maximum temperature: +167°F (+75°C).

9B-2-8. PORTABLE OPERATION

9B-2-9. The use of the HP Model 5310A Battery Pack enables the 5300A Measuring System and 5302A Universal Counter to be used in areas removed from ac power sources. The 5310A Battery Pack typically provides five hours of portable operating time before recharging. Tables 1-2 and 1-4 of 5300A portion of the manual lists the HP 5310A Battery Pack as an available accessory. Documentation on the 5310A is also included in Sections IV through VIII of the 5300A portion of the manual. To prepare the 5300A/5302A for portable operation, refer to Paragraph 2-15 and Figure 2-2 steps a to c of 5300A portion of manual.

SECTION IX B
5302A UNIVERSAL COUNTER
SUBSECTION III
OPERATION

9B-3-1. OPERATING INFORMATION

9B-3-2. The 5302A Universal Counter Plug-on may be used to measure frequencies up to 50 MHz, Period and Period Average to 1 MHz, Time Interval from 500 nsec to 1000 seconds or Ratio measurements from 10 Hz to 10 MHz. The instrument may also be used to Totalize input signals.

9B-3-3. The instrument front panel contains several controls and connectors used to make measurements with Channel A or Channel B or are used to control both channels. Some of these controls are used in signal conditioning to enable the user to take advantage of the instrument's built-in precision.

9B-3-4. There are three basic signal conditioning controls used in both Channel A and/or Channel B. There are:

a. Sensitivity controls for Channel A and B.

b. Waveform controls for Channel A and B.

c. TIME BASE control for Channel A and B.

9B-3-5. SENSITIVITY CONTROLS (Both Channels). A typical signal may contain large harmonics or noise, which can introduce inaccuracies in the reading. These sources of error may be minimized by correct use of the various signal conditioning controls.

9B-3-6. The input amplifiers and trigger circuits of both channels include a "dead band" or hysteresis. In order to trigger the counter, the input signal must pass completely through this "dead band". Any noise or unwanted signal, cannot cause a false trigger unless the amplitude of the noise is greater than the "dead band". The SENSITIVITY control adjusts the width of the dead band so that it is small enough to trigger on the signal but large enough to reject noise and harmonics (as shown in Figure 9B-3-1).

9B-3-7. To set the SENSITIVITY control for the best reading, set the control full ccw and increase the SENSITIVITY (cw) until stable triggering occurs. Increase the SENSITIVITY a fraction more to allow for amplitude variations in the signals. If the signal contains large amplitude modulation, the sensitivity must be adjusted to trigger on all cycles of the carrier frequency. In this case, it may be preferable to begin with the highest sensitivity setting (full cw) then decrease the sensitivity (ccw) to reject any noise until the display is stable. The sensitivity setting is more easily adjusted with a fast gate time such as .1-second. Gate time may be increased for finer resolution.

9B-3-8. WAVEFORM CONTROLS (Both Channels). This switch is normally used in the " ∿ " position and for most signals including sine wave, square wave, sawtooth wave, and pulses which have an approximate 50% duty-cycle. The hysteresis dead band in this position is centered on the average value of the signal. Since the amplifier is ac coupled, a dc offset in the signal does not effect triggering.

9B-3-9. The two pulse positions on the waveforms switch should be used only with positive or negative pulses where the pulse width is short compared to the spacing between pulses. In this case, the average value of the signal is close to the baseline of the pulse which is not the optimum point to trigger the counter. In the positive pulse position, the dead band is offset to respond only to the positive segment of the pulse above the average value. In the negative pulse position, the dead band is offset to respond to the negative part of the signal. In either case, the effect of the SENSITIVITY control is to move the center of the dead band, as well as its width, so that the trigger circuits still respond only to the positive part or the negative part of the signal as shown in Figure 9B-3-1.

9B-3-10. TIME BASE CONTROL. The TIME BASE control switch provides four gate time positions (black) and seven multiplier settings (N white) for Ratio mode. It also provides decade-step resolution settings from .1 μsec to 1 ms (blue) for Period or Time Interval measurements. These various positions are selectable for Channel A and/or B through the FUNCTION switch. These are:

a. AUTO. This is the most useful setting for measuring an unknown frequency. It will automatically select a gate time of:

1-second for frequencies up to 900 kHz when using Channel B and up to 9 MHz when using Channel A.

0.1-second for frequencies between 900 kHz and 9 MHz when using Channel B and 9 MHz to 50 MHz when using Channel A.

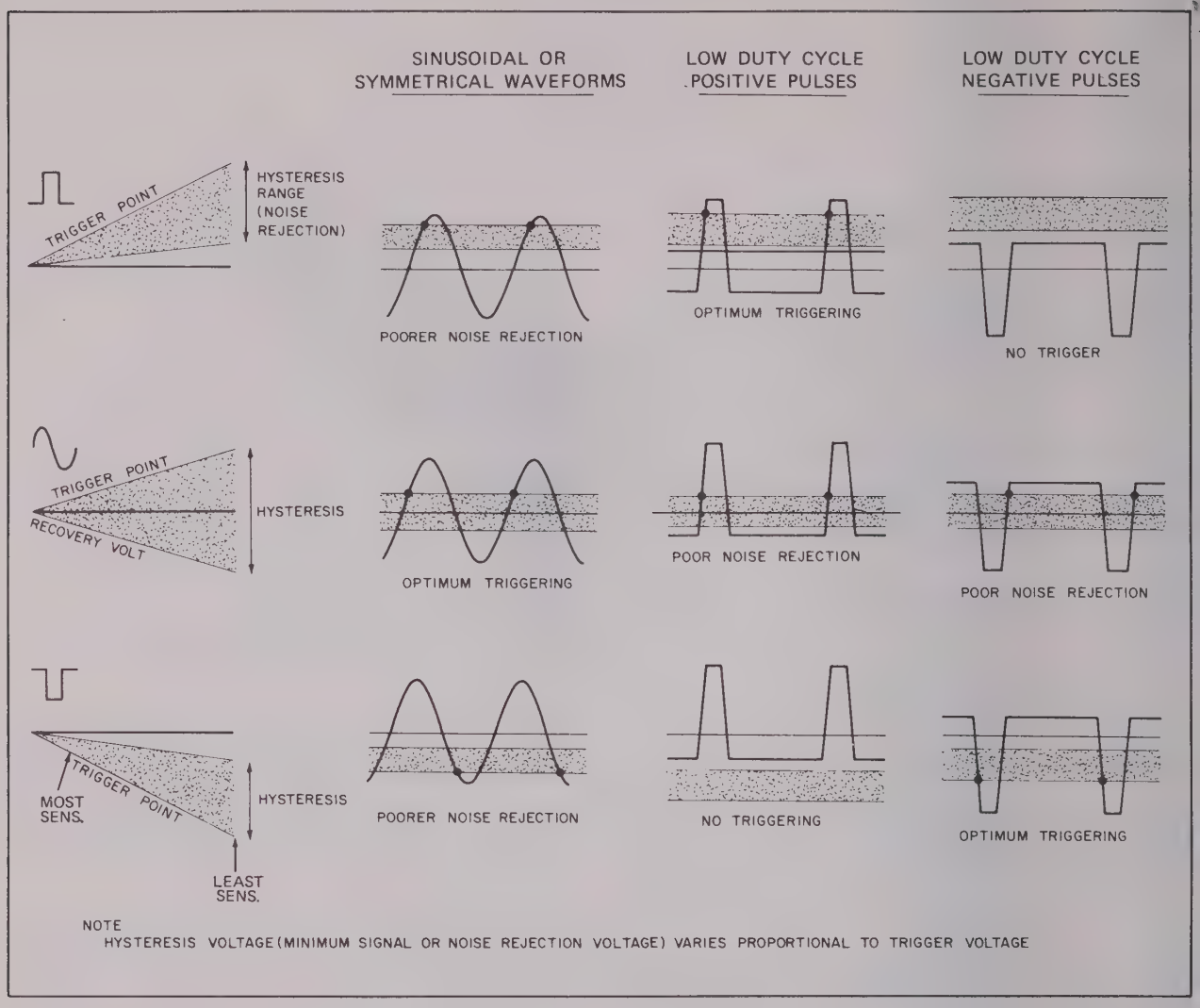
The display will never overflow in the AUTO position. The recycle time is held constant at 1-second plus the sample rate time for all frequencies.

b. 0.1 SEC. This position provides the fastest recycle time with a constant 10 Hz resolution when using Channel B and 100 Hz resolution when using Channel A. It is most useful for monitoring fast changes in the input frequency and for setting the signal conditioning controls.

c. 1 SEC. Provides constant 1 Hz resolution when using Channel B and 10 Hz resolution when using Channel A. Since the recycle time is the same as in AUTO this position offers an advantage only for measuring signals above 900 kHz with a 1 Hz resolution. Display will overflow above 1 MHz.

d. 10 SEC. Provides 0.1 Hz resolution in Channel B and 1 Hz resolution in Channel A. This setting is not available in AUTO and must be selected manually if the extra precision is required.

Figure 9B-3-1. Signal Conditioning by Waveform Switch and Sensitivity Control



e. N (white). Provides decade-step multiplier settings when FUNCTION switch is set to RATIO.

f. PERIOD/T.I. (blue). Decade step resolution settings may be selected when using Period B or T.I. A to B modes.

9B-3-11. MODES OF OPERATION

9B-3-12. The 5302A offers seven modes of operation and a Self-Check position. Some of the modes are available on both channels while other modes are available only on one channel (either A or B). In all cases, the modes are selected by the FUNCTION switch. The modes are:

a. Frequency (Channel A or B).

b. Period (Channel B only).

c. Time Interval (Channel A to B).

d. Period Average (Channel B only).

e. Ratio, $\frac{B}{A}$ X N (Channel A and B)

f. Totalize, OPEN/CLOSE B (Channel B only).

g. Check Mode.

9B-3-13. Frequency Mode, Channel A

9B-3-14. Frequency measurements using Channel A enables the user to make frequency measurements from 10 Hz to 50 MHz. When using Channel A the input signal is prescaled by 10.

9B-3-15. Frequency Mode, Channel B

9B-3-16. Frequency measurements using Channel B enables the user to make frequency measurements from 10 Hz to 10 MHz. Since no prescaling occurs, higher resolution measurements can be made using Channel B.

9B-3-17. Period Mode, Channel B

9B-3-18. The period mode allows single period measurements to be made with frequencies of 10 Hz to 1 MHz into Channel B. In Period B measurements the Time Base gate time is selectable from .5 μsec to 1 msec. The accuracy is ± 1 count ± time base accuracy ± trigger error.

9B-3-19. Time Interval Mode, Channel A to B

9B-3-20. The time interval mode allows time measurements, between points on one or two waveforms, to be made. The range of measurements is .1 μsec to 1000 seconds with .1 μsec to 1 msec resolution in decade steps. Channel A input signal opens the main gate and Channel B closes it. An output is available at the rear of the unit during the time the main gate is open. Accuracy is ± 1 count ± time base accuracy ± trigger error. The trigger error for any waveshape is less than

$$\pm \frac{0.005}{\text{Signal Slope (V/ }\mu\text{s)}\ \mu\text{s}}$$

9B-3-21. Period Average Mode, Channel B

9B-3-22. The period average mode allows multiple period averages to be made with frequencies of 10 Hz to 1 MHz into Channel B. Periods averaged is automatically selected from 1 to 10^3 for maximum resolution. For frequencies less than 110 Hz, one period is measured; for frequencies from 110 Hz to 1100 Hz, ten periods are averaged; for frequencies from 1100 Hz to 11 kHz, 100 periods are averaged; for frequencies above 11 kHz, 1000 periods are averaged.

9B-3-23. Ratio Mode, Channel B/A

9B-3-24. The ratio of the Channel B input signals (from 10 Hz to 10 MHz) to the Channel A input signals (from 10 Hz to 1 MHz) times multiplier N, can be measured. Multiplier is selectable from 10 to 10^7. Accuracy is ± 1 count of Frequency B, ± trigger error of Frequency A.

9B-3-25. Totalizing Mode, Channel B

9B-3-26. Input Signals up to 10 MHz, applied to Channel B can be totalized. Totalizing is initiated by pressing the OPEN/CLOSE B switch and terminated by pressing the OPEN/CLOSE B switch a second time.

9B-3-27. CHECK Mode

9B-3-28. The Check mode provides a position where the instrument 10 MHz oscillator and counting logic is verified. The 5300A displays 10.0000 MHz ± 1 count when circuits are functioning properly.

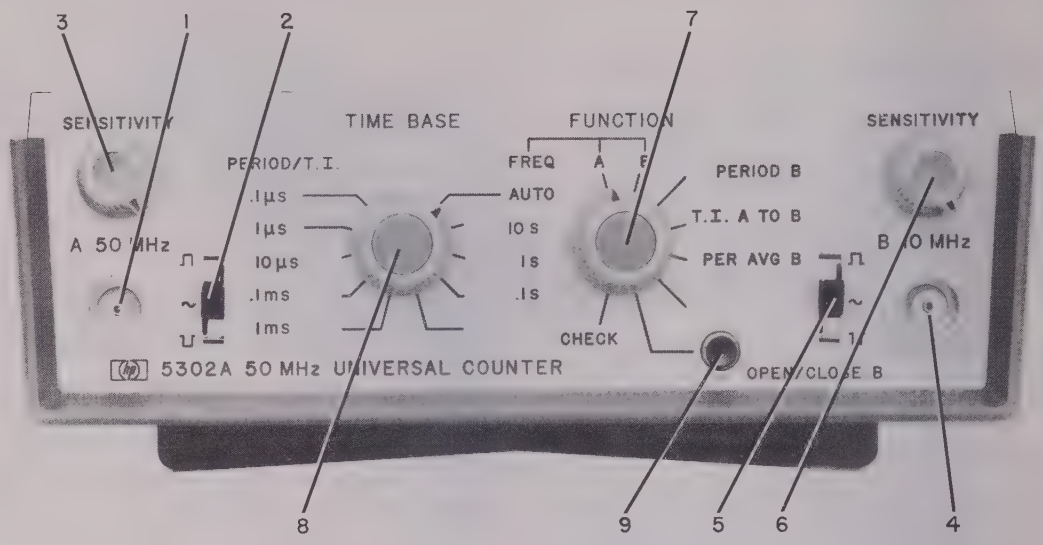
9B-3-29. CONTROLS AND CONNECTORS

9B-3-30. Figures 9B-3-2 and 9B-3-3 list the various front panel controls and connectors and the rear panel connector.

9B-3-31. OPERATING PROCEDURES

9B-3-32. The operating procedures for making measurements in the various modes are listed in Figures 9B-3-4 through 9B-3-10.

Figure 9B-3-2. Front Panel Controls and Connectors



CHANNEL A
Grouped on left side of panel

1. "A 50 MHz" connector. Input signals from 10 Hz to 50 MHz can be measured using this connector. Input signal is prescaled by 10.

2. Waveform Switch. Set to correspond to one of three types of input signals. (See Paragraph 9B-3-8 for correct adjustment.)

   a. ⎍ : Input signals to be measured is positive-going pulse of low duty-cycle.

   b. ∿ : Input signal to be measured is sinusoidal or is another type of signal with about a 50% duty-cycle.

   c. ⎎ : Input signal to be measured is negative-going pulse of low duty-cycle.

3. SENSITIVITY. Potentiometer adjusts counter channel A sensitivity; maximum sensitivity is at full cw.

CHANNEL B
Grouped on right side of panel

4. "B 10 MHz" connector. Input signals from 10 Hz to 10 MHz can be measured using this connector.

5. Waveform switch. Set to correspond to one of three types of input signals. (See Paragraph 9B-3-8 for correct adjustment.)

   a. ⎍ : Input signals to be measured is positive-going pulse of low duty-cycle.

   b. ∿ : Input signal to be measured is sinusoidal or is another type of signal with about a 50% duty-cycle.

   c. ⎎ : Input signal to be measured is negative-going pulse of low duty-cycle.

6. SENSITIVITY. Potentiometer adjusts counter Channel B sensitivity; maximum sensitivity is at full cw.

Figure 9B-3-2. Front Panel Controls and Connectors (Continued)

7. FUNCTION. Eight position switch used to select the desired mode of operation. The positions are:

a. FREQ A. Enables frequency measurements of 10 Hz to 50 MHz to be made using Channel A connector and signal conditioning controls.

b. FREQ B. Enables frequency measurements of 10 Hz to 10 MHz to be made using Channel B connector and signal conditioning controls.

c. PERIOD B. Enables single period measurements to be made from Channel B with frequencies of 10 Hz to 1 MHz.

d. T.I. A to B. Enables time interval measurements to be made between signals into Channel A and signals into Channel B. Channel A starts measurements, Channel B stops it.

e. PER AVG B. Enables multiple period averages to be made from Channel B with frequencies of 10 Hz to 1 MHz. Periods averaged is automatically selected from 1 to 10^3.

f. RATIO $\frac{B}{A}$ X N. Enables the ratio of Channel B signals to Channel A signals to be taken. Channel A input is 10 Hz to 1 MHz and Channel B input is 10 Hz to 10 MHz. Multiplier (N) is selectable from 10 to 10^7.

g. OPEN/CLOSE B. Enables input signals to Channel B (10 Hz to 10 MHz) to be totalized. Totalizing is initiated by pressing the OPEN/CLOSE B switch and terminated by pressing this switch a second time. Restarted by pressing the switch a third time.

h. CHECK. Self-Check position verifies that the 5300A 10 MHz crystal oscillator and the counting logic is functioning correctly.

8. TIME BASE. This 10-position switch performs three functions:

a. Gate time controls for frequency measurements.

b. Period/Time Interval resolution control.

c. Ratio Multiplier control for ratio measurements.

FREQ. (black) Gate time positions are:

a. AUTO. Automatically selects the measurement gate time needed to fill the display for maximum resolution for the signal being measured with a maximum time of 1 second.

b. 10S, 1S, .1S. Counter gate time is 10 seconds, 1-second, or .1-second corresponding to the switch position.

PERIOD/T.I. (blue) positions are:

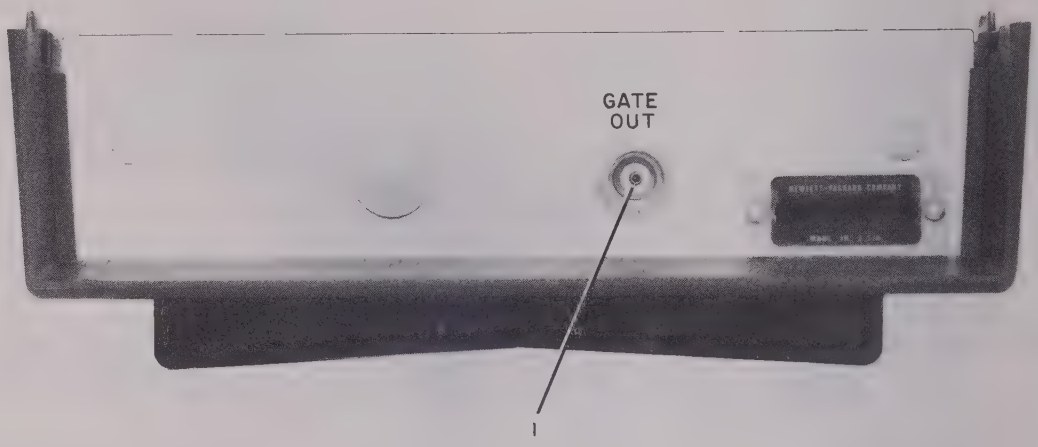
.1 μs, 1 μs, 1 ms, 1 ms. In Period measurements and Time Interval measurements, the resolution of the measurement is adjustable from .1 μsec to 1 msec in decade steps.

"N" Multiplier (white) positions are:

10, 10^2, 10^3, 10^4, 10^5, 10^6, 10^7. In Ratio mode the multiplier is selectable, in decade steps, from 10 to 10^7.

9. OPEN/CLOSE B Pushbutton switch, effective in indicated position of FUNCTION switch. Totalizing of Channel B input signals started by pressing this switch and terminated by pressing it a second time. Restarted by pressing the switch a third time.

Figure 9B-3-3. Rear Panel Connector

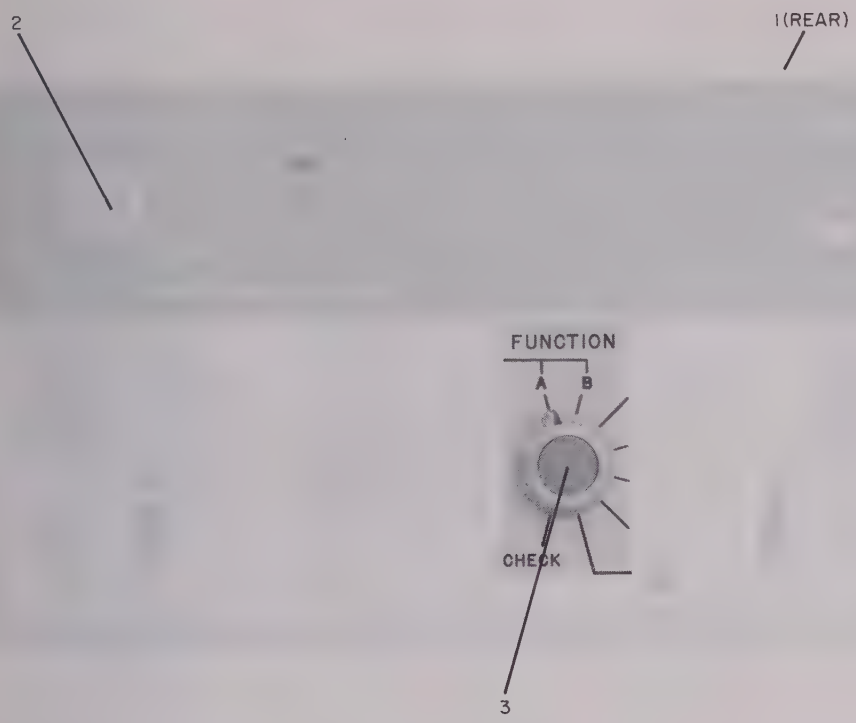


1. GATE OUT: A TTL-LOW level is available while the instrument gate is open.

Caution

DO NOT CONNECT EXTERNAL VOLTAGES TO GATE-OUT CONNECTOR.

Figure 9B-3-4. Making Self-Check Measurements

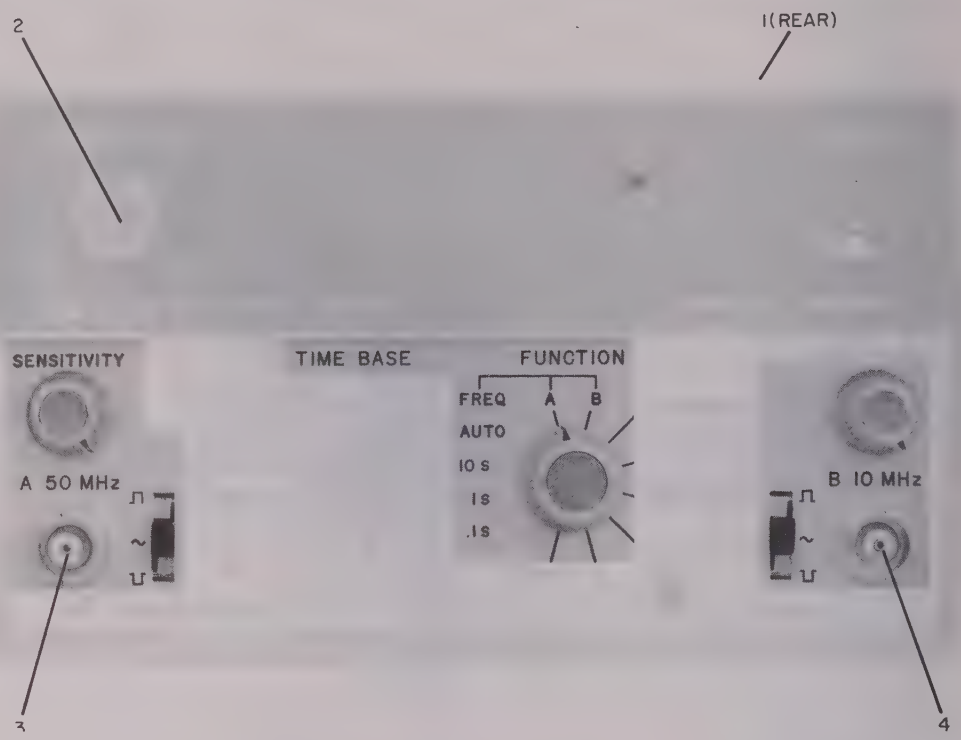


1. Connect ac power to 5300A ac receptacle.

2. Turn ac power "on" with 5300A SAMPLE RATE control. Adjust SAMPLE RATE for desired display time.

3. Set 5302A FUNCTION SWITCH TO CHECK; TIME BASE switch may be set to any position. Display should be 10.0000 MHz ± 1 count.

Figure 9B-3-5. Making Frequency Measurements Using Channel A or B



1. Connect ac power to 5300A ac LINE receptacle.

2. Turn ac power "on" with 5300A SAMPLE RATE control and adjust sample rate for desired display time.

3. For frequencies 10 Hz to 50 MHz use Channel A as follows:

   a. Set FUNCTION to "A".

   b. Set "A" Waveform switch to " ∿ " and TIME BASE to an appropriate gate time (see paragraph 9B-3-8 for Waveform controls operating information). For low duty cycle pulse measurements where pulse widths are short compared to pulse spacing, set Waveform "A" switch to " ⎍ " or to " ⎏ " depending on input pulse polarity.

   c. Set "A" SENSITIVITY to full ccw (see SENSITIVITY CONTROLS operating information, paragraph 9B-3-5).

   d. Connect input signal to be measured to "A 50 MHz" connector.

   e. Slowly adjust SENSITIVITY cw for a stable display.

   f. Set TIME BASE to desired gate time.

   g. Instrument display is the input signal frequency.

4. For frequencies 10 Hz to 10 MHz use Channel B as follows:

   a. Set FUNCTION to "B".

   b. Set "B" Waveform switch to " ∿ " and TIME BASE to an appropriate gate time (see paragraph 9B-3-8 for Waveform Controls operating information). For low duty cycle pulse measurements where pulse widths are short compared to pulse spacing, set Waveform "B" switch to " ⎍ " or to " ⎏ " depending on input pulse polarity.

   c. Set "B" SENSITIVITY to full ccw (see SENSITIVITY CONTROLS operating information, paragraph 9B-3-5).

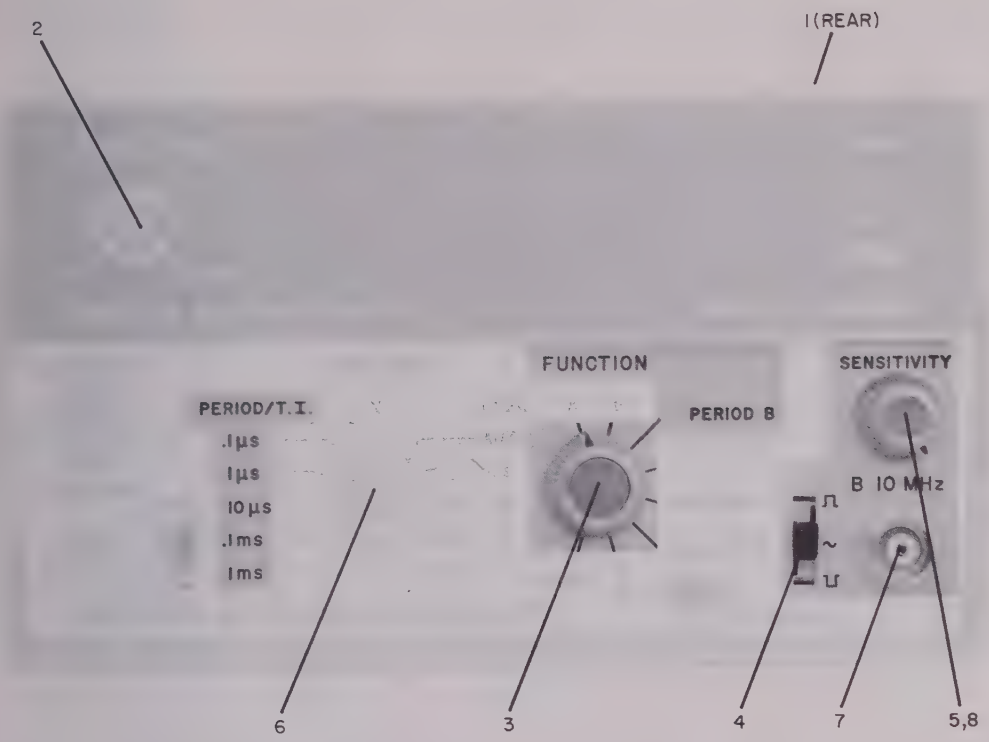
   d. Connect input signal to be measured to "B 10 MHz" connector.

   e. Slowing adjust "B SENSITIVITY control cw for a stable display.

   f. Set TIME BASE to desired gate time.

   g. Instrument display is the input signal frequency.

Figure 9B-3-6. Making Period Measurements



1. Connect ac power to 5300A ac LINE receptacle.

2. Turn ac power "on" with 5300A SAMPLE RATE control. Adjust SAMPLE RATE for desired display time.

3. Set 5302A FUNCTION switch to PERIOD B.

4. Set "B" Waveform switch to correspond to type of signal being measured (see Paragraph 9B-3-8 for Waveform Controls operating information).

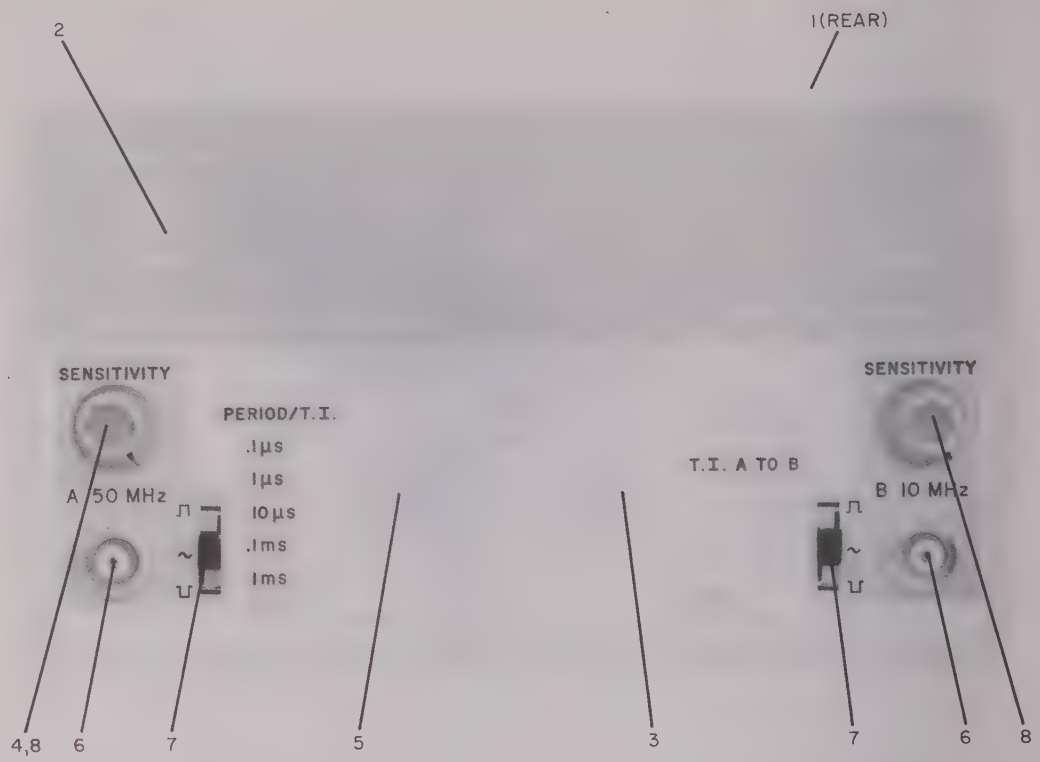
5. Adjust "B" SENSITIVITY to full ccw (see Paragraph 9B-3-5 for SENSITIVITY CONTROLS operating information).

6. Set TIME BASE to desired PERIOD resolution (.1 µs to 1 ms).

7. Connect input signal (10 Hz to 1 MHz) to "B 10 MHz" connector.

8. Adjust "B" SENSITIVITY control slowly cw for a stable display.

Figure 9B-3-7. Making Time Interval Measurements



1. Connect ac power to 5300A ac LINE receptacle.

2. Turn ac power "on" with 5300A SAMPLE RATE control and adjust sample rate for desired display time.

3. Set 5302A FUNCTION switch to T.I. A to B.

4. Adjust "A" SENSITIVITY control to full ccw and "B" SENSITIVITY controls to full cw (see paragraph 9B-3-5 for SENSITIVITY CONTROLS operating information).

5. Set TIME BASE to desired T.I. resolution to be counted (.1 µs to 1 ms).

6. If the Start and Stop signals are from separate sources connect the Start signal to "A 50 MHz" connector and the Stop signal to "B 10 MHz" connector. If the Start and Stop signals are from a common source, use a BNC "Tee" connector to interconnect the signal source, "A 50 MHz" channel and "B 10 MHz" channel.

7. Set the "A" Waveform switch to correspond to the type of signal connected to A 50 MHz connector. Set the "B" Waveform switch to correspond to the type of signal connected to B 10 MHz connector.

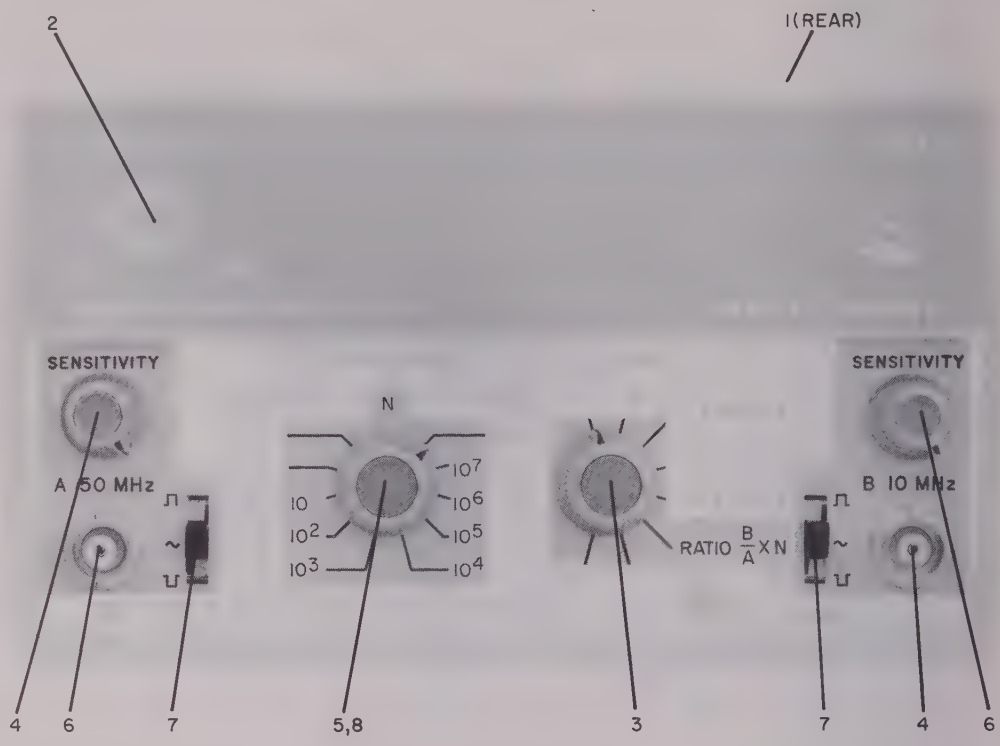
8. Slowly adjust the "A" SENSITIVITY cw until a display is observed, then adjust "B" SENSITIVITY slowly ccw until the display is stable.

9. The Time interval is displayed in µsec, msec, or seconds depending on T.I. setting selected.

Figure 9B-3-8. Making Period Average Measurements

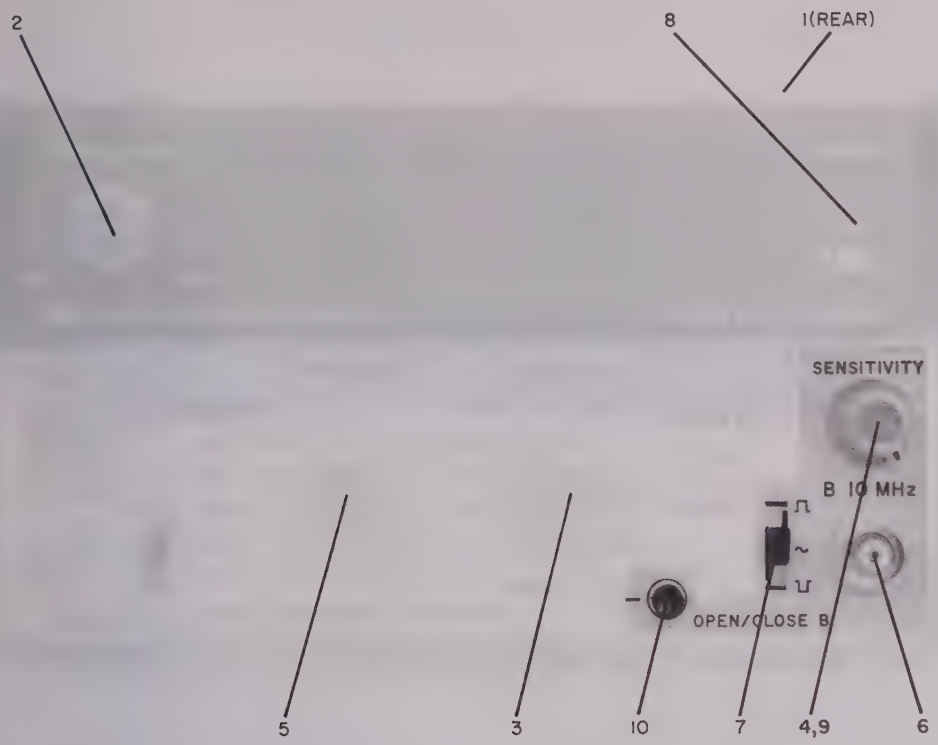
1. Connect ac power to 5300A ac LINE receptacle.
2. Turn ac power "on" with 5300A SAMPLE RATE control. Adjust SAMPLE RATE for desired display time.
3. Set 5302A FUNCTION to PER AVG B.
4. Adjust "B" SENSITIVITY to full ccw (see Paragraph 9B-3-5 for SENSITIVITY CONTROLS operating information).
5. TIME BASE adjustment is not required; instrument gate-time is automatic. Periods averaged are 1 to 10^3.
6. Connect input signal (10 Hz to 1 MHz) to "B 10 MHz" connector.
7. Set "B" Waveform switch to correspond to type of signal being measured (see Paragraph 9B-3-8 for Waveform Controls operating information).
8. Adjust "B" SENSITIVITY control slowly cw for a stable display.

Figure 9B-3-9. Making Ratio Measurements



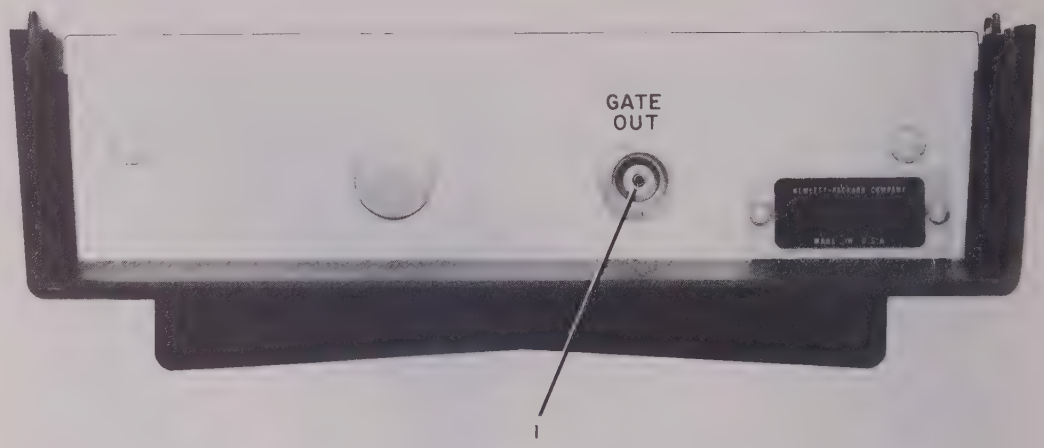
1. Connect ac power to 5300A LINE receptacle.
2. Turn ac power "on" with 5300A SAMPLE RATE control and adjust sample rate for desired display time.
3. Set 5302A FUNCTION switch to RATIO $\frac{B}{A}$ X N.
4. Set "A" and "B" SENSITIVITY controls full cw (see Paragraph 9B-3-5 for SENSITIVITY CONTROLS operating information).
5. Set TIME BASE N (white) to desired setting (10 white to 10^7 white).
6. Connect lower frequency signal to "A 50 MHz" connector (10 Hz to 1 MHz); connect higher frequency signal to "B 10 MHz" connector (10 Hz to 10 MHz).
7. Set "A" and "B" Waveform switches to correspond to type of signals connected to "A" and "B" input connectors.
8. Divide display by N multiplier setting (white numbers) to obtain ratio.

Figure 9B-3-10. Making Totalizing Measurements



1. Connect ac power to 5300A ac LINE receptacle.
2. Turn ac power "on" with 5300A SAMPLE RATE control. Adjust SAMPLE RATE for desired display time.
3. Set 5302A FUNCTION to OPEN/CLOSE B.
4. Adjust "B" SENSITIVITY to full ccw (see paragraph 9B-3-5 for SENSITIVITY CONTROLS operating information).
5. TIME BASE adjustment is not required; instrument gate is controlled by operator when OPEN/CLOSE B pushbutton is pressed.
6. Connect input signal (10 MHz maximum) to "B 10 MHz" connector.
7. Set "B" Waveform switch to correspond to type of signal being totalized (see paragraph 9B-3-8 for Waveform Controls operating information).
8. Press RESET; press OPEN/CLOSE B switch; C lamp should come on.
9. Slowly adjust "B" SENSITIVITY cw until counting occurs on display. Display will accumulate at a rate dependent on input signal frequency.
10. When display has accumulated the desired number of counts, press OPEN/CLOSE B to stop totalizing.
11. If the operator wants to totalize from the number accumulated in the display, press the OPEN/CLOSE B switch. If a new totalizing measurement is made, press RESET before pressing OPEN/CLOSE B switch.

Figure 9B-3-11. Using GATE OUT Connector



The 5302A rear-panel GATE OUT connector provides a TTL low level signal during the time the instrument gate is open. This signal can be used, when making Period, Time Interval and Period Average measurements, to control an oscilloscope so that only the measured portion of the signal is displayed by the oscilloscope.

1. To use this feature in Period (Figure 9B-3-6) or Period Average (Figure 9B-3-8) modes proceed as follows:

   a. Connect the signal to be measured to oscilloscope Channel A or B. Connect the 5302A GATE OUT connector, using a BNC Tee, to the oscilloscope rear-panel Z AXIS input and the oscilloscope front-panel EXT INPUT.

   b. Set HP 180A oscilloscope controls as follows:

      TRIGGER to EXT.

      SLOPE to +.

      Display to A + B.

      Coupling to ACF.

      SWEEP MODE to NORM.

      TIME/CM for one complete cycle of signal.

   c. Set remaining oscilloscope controls for a useable display.

   d. To more easily view the measured portion of the input signal, reduce the oscilloscope INTENSITY.

   e. In PER AVG Mode, the periods averaged are automatically selected. The change-over point may be monitored by varying the input frequency and observing the number of cycles displayed on the oscilloscope.

2. To use this feature in Time Interval Mode (Figure 9B-3-7) proceed as follows:

   a. Connect equipment as shown in Table 9B-5-1, No. 6, Figure C, Time Interval Measurements.

   b. In addition to connections made in step a, connect 5302A GATE OUT connector, using a BNC Tee, to oscilloscope rear-panel Z AXIS input and to oscilloscope front-panel EXT INPUT.

   c. Set HP 180A oscilloscope controls as follows:

      TRIGGER to EXT.

      SLOPE to —.

      Coupling to ACF.

      SWEEP MODE to NORM.

      TIME/CM for one complete Time Interval of signal.

   d. Set remaining oscilloscope controls for a useable display.

   e. To more easily view the measured time interval portion of the input signals, reduce the oscilloscope INTENSITY.

SECTION IX B
5302A UNIVERSAL COUNTER
SUBSECTION IV
THEORY OF OPERATION

9B-4-1. INTRODUCTION

9B-4-2. This subsection describes the theory of operation for the 5302A 50 MHz Universal Counter. Basic operation of gates and certain amplifiers is located in Section IV of the 5300A portion of the manual.

9B-4-3. To simplify measurement making when using channel A and/or channel B, refer to operating information starting with paragraph 9B-3-1 for optimum adjustment of the various controls.

9B-4-4. 5302A CIRCUIT THEORY (Figure 9B-8-1)

9B-4-5. INPUT AMPLIFIERS. The input signals at J1 or J2 are coupled to input buffers Q1, Q2 through C1 or C2. Signals greater than ±7 volts are clipped by the diodes CR4, CR6, CR9, CR10. Gate bias for Q1 and Q2, is provided by breakdown diode CR7 and resistors R9 and R11. Q1 and Q2 provide impedance-conversion from the 1 megohm INPUT to the 1 kΩ SENSITIVITY controls R1 and R2. R1 and R2 adjust the signal amplitude applied to the differential amplifiers U8A and U13A. The signal is limited to 1.4V p-p by CR1, CR3, and CR2, CR5. The differential amplifiers are biased at the proper point by R12, R13, R15, and R16 from the differential amplifiers' internal bias supply.

9B-4-6. In channel A, the U13A differential output is fed to the differential Schmitt-Trigger U13C, which converts the signal to fast risetime square waves compatible with digital logic, and rejects noise which may be present with the desired signal. Buffer stage U13B drives the prescaler and level converter.

9B-4-7. In channel B the U8A amplifier output is fed to the Schmitt-Trigger, U8C. U8B is a unity-gain amplifier whose output supplies the Schmitt-Trigger bias voltage, and buffers it from the input bias source.

9B-4-8. A dc offset voltage in the "pulse positions" of S1 or S2 is applied to the amplifiers and Schmitt-Triggers to make them handle low duty-cycle pulses. In channel A the offset is applied directly to the Schmitt-Trigger through R5 or R6. In channel B the offset is applied to the input amplifier through R3 or R4.

9B-4-9. Channel A signals are available to the logic circuits either direct or prescaled by 10 through U18 and U19. In the Frequency Mode, the signals at the output of buffer U13B go to the ECL decade-divider U18 and U19. The prescaled output from the decade goes to U26A, which converts the ECL logic levels to TTL levels for use in the remainder of the 5302A.

9B-4-10. In Time Interval and Ratio measurements an unprescaled output is desired and the channel A signal is taken from buffer amplifier U13B directly to a level-translator gate U26E. To ensure that the leading edge of the signal triggers the circuitry, the "CHAN A" signal goes to EXCLUSIVE OR gate U27C(9). The other input of this gate is controlled by the channel A waveform switch S1. In the ⎍ and ∿ positions, this input is low, while in the ⎍⎍ position, it is pulled high through R52. Thus, in ⎍ pulse and ∿ the gate (U27C) acts as a non-inverting buffer while in ⎍⎍ it acts as an inverter.

9B-4-11. The output of the channel B Schmitt-Trigger goes directly to the U26(3,4) level-translator gate and then to an EXCLUSIVE OR Inverter/Buffer described in paragraph 9B-4-10.

9B-4-12. FREQUENCY MODE (Figures 9B-5-2 and 3)

9B-4-13. In frequency A or frequency B modes, the signal from one of the input amplifiers CHA "OUT" and CHB "OUT" is applied to F1 A1P1(5) through U16 F1 switch. The F1 frequency is determined by counting F1 for an accurately known period of time. This counting time or gate-time can be .01 sec, .1 sec, 1 sec, or 10 sec, depending upon frequency and resolution desired.

9B-4-14. Accurate measurement periods are derived from a 10 MHz crystal-controlled oscillator through a chain of 8-decade dividers. The outputs of the dividers are multiplexed onto a single line and gated to provide a series of 9 pulses in 10 seconds. The first, or start pulse indicates "time zero" and the beginning of a measurement cycle (see Figure 9B-4-1). The other pulses are generated at precisely 1 μsec, 10 μsec, 100 μsec, 1 ms, 10 ms, 100 ms, 1 sec, and 10 sec after the start pulse. Because the pulses are logarithmically spaced in time, this line is termed "$\overline{\text{LOG}}$" output. Another timing signal, TB OUTPUT, (time base output), is available which gives a level change concurrent with one of the $\overline{\text{LOG}}$ pulses (see Figure 9B-4-2). The specific time from the start pulse to this level change is programmed by a three-line code (TB SELECT A, B, C).

Figure 9B-4-1. LOG Cycle

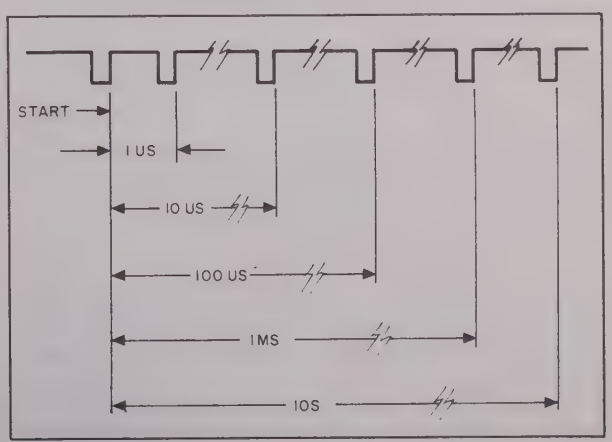
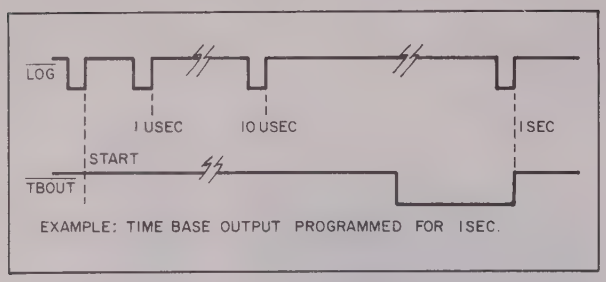


Figure 9B-4-2. TIME BASE/LOG Outputs

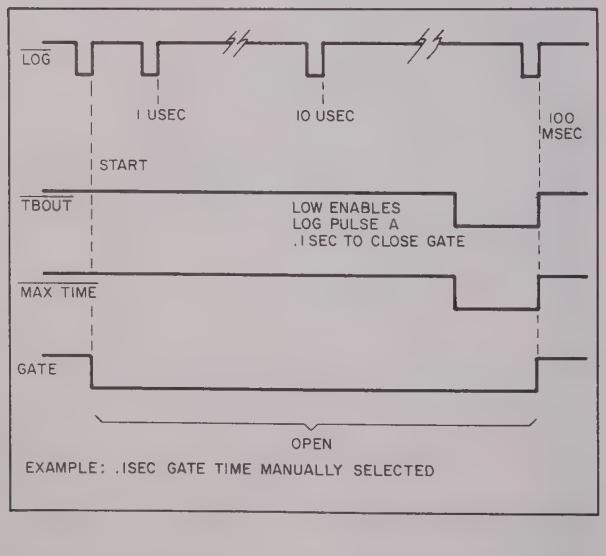


9B-4-15. The eight-decade dividers and the logic to control LOG and TIME BASE OUTPUT are all contained in a single MOS-LSI Integrated Circuit in the 5300A mainframe.

9B-4-16. The main gate which controls the flow of F1 into the counting decades, is opened by the Start Pulse and is closed by one of the other eight Log Pulses. The closing can be enabled by either of two lines going to a low state, "9" and MAX TIME.

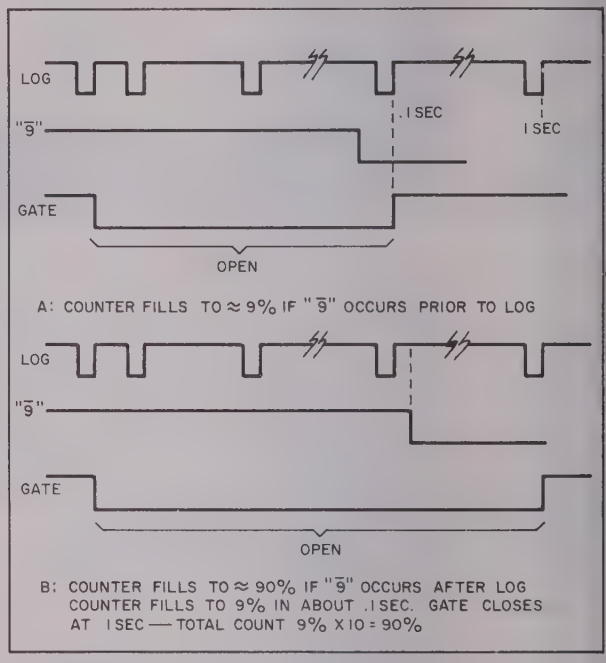
9B-4-17. MANUAL GATE SELECTION. Manually selecting 10s, 1s, or .1s gate times, generates an appropriate code which programs the time base output so that immediately preceding the correct LOG pulse, the TIME BASE OUTPUT goes low (see Figure 9B-4-3). MAX TIME is immediately pulled low by the 5302A through Q3 and U12A and enables the closing of main gate. The next LOG pulse closes the Main Gate and terminates the measurement.

Figure 9B-4-3. Manual Gate Selection



9B-4-18. AUTO GATE Selection. In automatic mode (Timing shown in Figure 9B-4-4) the control line "9" is enabled (forced high state is removed), and the counting cycle starts as in manual gate selection. When the display reaches 9% of capacity, 090000 counts, the "9" line goes low, enabling gate closing on the next LOG pulse. This AUTO feature means that the display will be from 9% to 90% full; 9% if "9" goes low *just before* a LOG pulse and 90% if it occurs *just after* a LOG pulse. To prevent the gate time in AUTO from becoming excessively long with low input frequencies, a 1 second maximum is placed on it, by coding 1 second into the TB OUTPUT. Thus, on signals from 10 Hz to 900,000 Hz, the gate time is 1 sec; from 900,001 Hz to 9.0 MHz the gate time is .1 sec, and above 9.0 MHz the gate time is .01 sec.

Figure 9B-4-4. AUTO GATE Selection



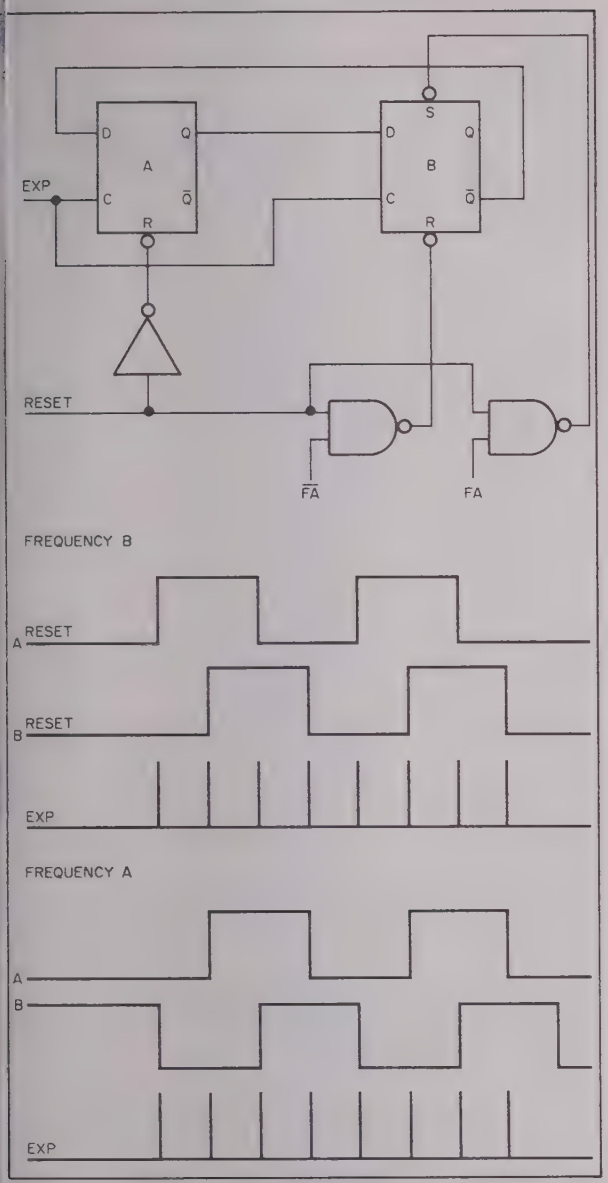
9B-4-19. In automatic operation (AUTO), the gate time is not known until the end of the measurement; the proper decimal point or units annunciators must then be determined. The length of the gate time is determined by counting the EXPONENT signal, which is the "LOG" signal that occurs while the gate is open (i.e., LOG without the start pulse). The exponent is counted by the 4-bit ripple counter consisting of U22A and U22B.

9B-4-20. The 5302A has four possible gate times; .01 second, .1 second, 1 second and 10 seconds. The .01, .1 and 1 second times are available in AUTO or "manual" positions. The 10 second gate-time is available only in "manual" position (10 S).

9B-4-21. The outputs of the exponent counter are stored in the exponent storage latches U21A,B during the measurement cycle. The outputs of these latches are then used in decoding.

9B-4-22. All frequency-related decimal point and units information is derived from the four-state exponent counter U22A and B (see Figure 9B-4-5). The channel A prescaling and the decoding used makes it necessary to reset the exponent counter to different initial states as shown in Table 9B-4-1.

Figure 9B-4-5. Exponent Counter



9B-4-23. PERIOD AND TIME INTERVAL MODES (Figures 9B-5-4 and 9B-5-5)

9B-4-24. The logic circuits for period and time interval measurement are common except for source selection. In period mode, successive leading edges of the channel B waveform open, then close, the main gate; while in Time Interval Mode, a leading edge of the channel A waveform opens the gate and the next leading edge of the channel B waveform closes the gate.

9B-4-25. In Period and Time Interval Mode the clock or timebase output is counted for one period of the input signal or for the time interval between two selected signals. The clock or timebase output signal is sent to the 5300A as F1 (A1P1(5)) through U16 F1 switch. The timebase is controlled by S2 through Time Base decoders U3A, U3B and U4A. The three-bit Time Base code is shown in Table 9B-4-1.

Table 9B-4-1. TIME BASE CODE

	TBC	TBB	TBA
1 μs	0	0	0
10 μs	0	0	1
.1 ms	0	1	0
1 ms	0	1	1
10 ms	1	0	0
.1 S	1	0	1
1 S	1	1	0
10 S	1	1	1

9B-4-26. The 5300A main gate is controlled by $\overline{\text{OPEN}}$ and $\overline{\text{CLOSE}}$ signals from U5A and U17B which gates the outputs of U7A. In Period Mode, channel B clocks U7A through U11 while in Time Interval channel A, *then* channel B clocks U7A through U11. In time interval mode U6C and U6D control the application of channel A or channel B signals to U7A. Latch U5A, D allows only one start pulse per display cycle.

9B-4-27. In period and time interval modes, the display cycle is activated by pulling $\overline{\text{MAX TIME}}$ (A1P1(17)) low through C26, R46, CR16 and U12A when the 5300A main gate closes. Units and decimal points are decoded from the TIME BASE switch positions. The $\overline{\text{LOG}}$ signal is disabled in time interval and period modes (pulled low) to prevent opening of the 5300A main gate.

9B-4-28. OPEN/CLOSE B MODE (Figure 9B-5-8)

9B-4-29. In open/close mode the channel B input is counted while the 5300A main gate is open. Channel B signal is fed to A1P1(5) as F1 signal by U16 F1 switch. The main gate is controlled by the front-panel pushbutton switch S4 through OPEN/CLOSE B latch U1B and U1C which conditions the switch signal. The OPEN/CLOSE latch signal is routed through U11 data switch and "clocks" U7A flip-flop. The output from U7A goes to U5A and U17B which generate the $\overline{\text{OPEN}}$ and $\overline{\text{CLOSE}}$ signals used to control the 5300A main gate. The $\overline{\text{TRANSFER}}$ line (A1P1 (20)) is set low to continuously transfer count information from the decades to the display. The $\overline{\text{LOG}}$ and $\overline{\text{MAX TIME}}$ lines are both inhibited; $\overline{\text{LOG}}$ is inhibited to prevent the gate from opening; $\overline{\text{MAX TIME}}$ is inhibited to prevent the display cycle from being initiated when the gate closes. The TIME BASE switch S2 is disabled through U2B and U5B in OPEN/CLOSE B mode.

9B-4-30. PER AVG B MODE (Figure 9B-5-6)

9B-4-31. Period Average function is totally automatic and operates similar to AUTO frequency mode except that the clock and input signals are interchanged. The clock signal is routed through U16 to F1 and counted, while channel B signal is fed through U12B and U15A to A1P1 (21) 1 MHz IN TB. The count will terminate after 1, 10, 100, or 1000 periods of the channel B input signals. U7B synchronizes the signal so that the first pulse is full width. The count termination is initiated either by a full display ($\overline{9}$) or by $\overline{\text{TBO}}$ signals. $\overline{\text{TBO}}$ is set so that a maximum of 1000 periods is averaged. Unit and decimal-point-decoding is from the output of the exponent counter latches U22A and B. Since period average is fully automatic, the timebase switch S2 is disabled by U2B.

9B-4-32. RATIO MODE (Figure 9B-5-7)

9B-4-33. In Ratio mode the channel B signals are counted for a given number of periods of channel A. The number selected by the time base switch position (white numbers) determines the number of periods. The channel B signal is routed to F1 by U16 and the channel A signal is routed to 1 MHz IN TB by U12B and U15A. The first pulse on the 1 MHz IN TB line is synchronized by U7B. No decimal point or units are decoded in ratio mode. F2 switch U25B and U15C, disable the clock from F2 at A1P1(7).

9B-4-34. CHECK MODE (Figure 9B-5-9)

9B-4-35. Setting the FUNCTION switch S3 to Check Mode (CHK) applies the 10 MHz clock through U16 to F1 at A1P1(5) and switches to automatic frequency mode via diode CR12. The TIMEBASE switch S2 is disabled through U5B and U2B.

SECTION IX B
5302A UNIVERSAL COUNTER
SUBSECTION V
MAINTENANCE

B-5-1. INTRODUCTION

3-5-2. This section contains maintenance and service formation for Model 5300A 5302A 50 MHz Universal ounter. Included are performance check procedures and sts to localize, isolate, and locate defective components.

B-5-3. RECOMMENDED TEST EQUIPMENT

3-5-4. Test equipment recommended for performance ecks, maintaining, troubleshooting and servicing the 00A 5302A 50 MHz Universal Counter is listed in able 5-1 of 5300A portion of the manual. Test equipent with equivalent characteristics may be substituted r equipment listed.

B-5-5. INSTRUMENT ACCESS

B-5-6. For access to plug-on assembly, separate the 300A from the 5302A as follows:

a. Turn ac power OFF and disconnect power cord.

b. Pull the two-side casting latches fully rearward (it s necessary to press the latch handles gently away from ne center of the instrument to unlock them).

c. When latches are fully extended rearward, the 5300A nd 5302A castings should be separated by about ⅛ inch.

d. Lift the 5300A gently away from the 5302A.

e. Separate 5302A 50 MHz BOARD ASSEMBLY from 302A casting as follows (refer to Figure 9B-5-1):

1. Press rear, plastic-nylon retaining clips on each side of 5302A casting and lift the rear of the 50 MHz Board Assembly to release it from the castings

2. Press front plastic-nylon retaining clips on each side of 5302A casting and lift the front of the 50 MHz Board Assembly to release it from the casting.

3. Lift 50 MHz Board Assembly from the casting.

f. Mate the 5302A 50 MHz Board Assembly to 5300A nd reapply ac power.

g. To reinstall the 50 MHz Board Assembly into the casting reverse procedure of steps d through f.

9B-5-7. PERIODIC MAINTENANCE

9B-5-8. To determine if the 5300A/5302A is operating properly within specifications, perform the In-Cabinet Performance Checks listed in Table 9B-5-1. These checks nay also be used for the 5300A performance checks when the 5300A 5302A combination is used.

9B-5-9. MAINTENANCE AND REPAIR

9B-5-10. BOARD REMOVAL. When removing the printed circuit board for replacement, repair, or servicing, always remove ac power and separate the board from the casting using Paragraph 9B-5-6 steps a to e.

9B-5-11. COMPONENT REPLACEMENT. When replacing a circuit board component use a low heat soldering iron. Heat must be used sparingly as damage to the circuit foil may result. Mounting holes may be cleaned out with a toothpick while heat is applied. Connection should be cleaned with a cleaning solution after component removal and replacement.

9B-5-12. INTEGRATED CIRCUIT REPLACEMENT. Two methods are recommended for removing integrated circuits:

a. Solder Gobbler. Solder is removed from board by a soldering iron with a hollow tip connected to a vacuum source. The IC is removed intact so it may be reinstalled if diagnosis is wrong.

b. Clip Out. This method is used when an IC is proven defective. Clip leads close to case, apply heat and remove leads with long nose pliers. Clean board holes with a toothpick and cleaning solution.

9B-5-13. INSTRUMENT TROUBLESHOOTING

9B-5-14. Trouble isolation can best be accomplished by first obtaining all possible information from the controls, connectors, and indicators on the 5300A and 5302A, then logically using this information to locate the defective component. If the performance checks indicate a malfunction or if instrument operation is suspect, perform the Self-Check procedures in Table 9B-5-1. For further tests, separate the 5302A from the casting and reconnect to 5300A using Paragraph 9B-5-6 steps a to e as a guide. Operating procedures in Subsection 9B-3 can be used to help understand operation. To test the 5302A, obtain the test equipment listed in Table 5-1 of the 5300A portion of the manual

9B-5-15. Figure 9B-5-2 to Figure 9B-5-9 are troubleshooting flow diagrams for each of the eight modes of operation. Signal flow is outlined for each mode and waveform test points and voltage level test points are indicated. The waveform or voltage level for each mode is included with the figures.

9B-5-16. FREQ "A" MODE TROUBLESHOOTING

9B-5-17. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to "A"; TIME BASE to .1 S; channel A waveform switch to "∩"; SENSITIVITY to max cw.

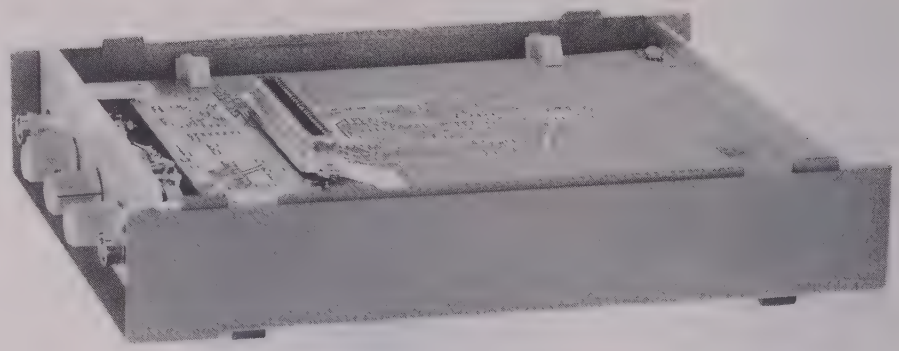
b. Connect a 651B Oscillator, 50-ohm output, set for 10 MHz, 100 mV rms to 5302A "A" 50 MHz connector.

c. Use an HP 180A Oscilloscope and an HP 10525A Logic Probe to check waveforms and voltage levels listed in Figure 9B-5-2.

d. 5300 display should be the same as the input frequency.

e. When using the logic probe, a High level is indicated by probe lamp "on". A Low level is indicated by probe lamp "off".

Figure 9B-5-1. Separation Procedure



STEP A

STEP B

-5-18. FREQ "B" MODE TROUBLESHOOTING

5-19. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to "B"; TIME BASE to .1 S; annel B waveform switch to "∿"; SENSITIVITY to max .

b. Connect a 651B Oscillator, 50 ohm output, set for MHz, 100 mVrms to 5302A "B" 10 MHz connector.

c. Use an HP 180A Oscilloscope and an HP 10525A gic Probe to check waveforms and voltage levels listed in gure 9B-5-3.

d. 5300 display should be the same as the input quency.

e. When using the logic probe, a High level is indicated probe lamp "on". A Low level is indicated by probe mp "off".

B-5-20. PERIOD B MODE TROUBLESHOOTING

3-5-21. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to PERIOD B; TIME BASE 1 μsec; channel B waveform switch to "∿"; SENSIIVITY to max cw.

b. Connect a 651B Oscillator, 50-ohm output, set for 1 IHz, 100 mV rms to 5302A "B" 10 MHz connector.

c. Use an HP 180A Oscilloscope and an HP 10525A ogic Probe to check waveforms and voltage levels listed in igure 9B-5-4.

d. 5300 display should be 000001 μs .

e. When using the logic probe, a High level is indicated y probe lamp "on". A Low level is indicated by probe amp "off".

B-5-22. TIME INTERVAL MODE ROUBLESHOOTING

B-5-23. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to T.I. A to B; TIME BASE to μsec; channel A and B waveforms switches "⎍"; ENSITIVITY (both channels) to max cw.

b. Connect two 222A Pulse Generators as shown in able 9B-5-1, Figure C. Perform Table 9B-5-1, item 6, steps through f, except with a time interval of 2 μsec.

c. Use an HP 180A Oscilloscope and an HP 10525A ogic Probe to check waveforms and voltage levels listed in igure 9B-5-5.

d. 5300 display should be 000002 μs .

e. When using the logic probe, a High level is indicated y probe lamp "on". A Low level is indicated by probe amp "off".

9B-5-24. PERIOD AVERAGE MODE

9B-5-25. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to PER AVG B; (TIME BASE is inoperative), channel B waveform switch to "∿"; SENSITIVITY to max cw.

b. Connect a 651B Oscillator, 50-ohm output, set for 1 MHz, 100 mV rms to 5302A "B" 10 MHz connector.

c. Use an HP 180A Oscilloscope and an HP 10525A Logic Probe to check waveforms and voltage levels listed in Figure 9B-5-6.

d. 5300 display should be 01.0000 μs.

e. When using the logic probe, a High level is indicated by probe lamp "on". A Low level is indicated by probe lamp "off".

9B-5-26. RATIO MODE TROUBLESHOOTING

9B-5-27. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to RATIO $\frac{B}{A}$ X N; TIME BASE TO N = 10^3; channel A and B waveform switches to "∿"; SENSITIVITY (both channels to max cw.

b. Connect a 651B Oscillator, 50-ohm output, set for 1 MHz, 100 mV rms to 5302A "A" 50 MHz connector. Connect another 651B oscillator, 50-ohm output set for 10 MHz, 100 mV rms to 5302A "B" 10 MHz connector.

c. Use an HP 180A Oscilloscope and an HP 10525A Logic Probe to check waveforms and voltage levels listed in Figure 9B-5-7.

d. 5300 display should be 010000.

e. When using the logic probe, a High level is indicated by probe lamp "on". A Low level is indicated by probe lamp "off".

9B-5-28. OPEN/CLOSE (TOTALIZE) MODE TROUBLESHOOTING

9B-5-29. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to OPEN/CLOSE; (TIME BASE is inoperative) channel B waveform to "∿"; SENSITIVITY to max cw.

b. Connect a 651B Oscillator, 50-ohm output, set for 10 Hz, 100 mV rms to 5302A "B" 10 MHz connector.

c. Press 5300A RESET, press 5302A OPEN/CLOSE switch. 5300 display should accumulate at a .1 second rate.

d. Use an HP 180A Oscilloscope and an HP 10525A Logic Probe to check waveforms and voltage levels listed in Figure 9B-5-8.

e. When using the logic probe, a High level is indicated by probe lamp "on". A Low level is indicated by probe lamp "off".

9B-5-30. CHECK MODE TROUBLESHOOTING

9B-5-31. To troubleshoot the 5302A proceed as follows:

a. Set 5302A FUNCTION to CHECK; TIME BASE to AUTO.

b. Use an HP 180A Oscilloscope and an HP 10525A Logic Probe to check waveforms and voltage levels listed in Figure 9B-5-9.

c. 5300 display should be 10 MHz ±1 count.

d. When using the logic probe, a High level is indicated by probe lamp "on". A Low level indicated by probe lamp "off".

9B-5-32. If trouble is traced to the 5300A mainframe, refer to 5300A Measuring System maintenance information located in Section V of the 5300A portion of the manual.

9B-5-33. SENSITIVITY ADJUSTMENT

9B-5-34. If channel A or channel B fail to meet their sensitivity specifications, as tested in Table 9B-5-1, items 2 and 3, perform the following procedure:

a. Connect an HP 651B Oscillator, set to 100kHz/50 mVrms/50 Ohms to channel A input.

b. Set 5302A SENSITIVITY (both channels) max cw and TIME BASE to 1 S; 5300A display should be 0.10000 MHz C.

c. If the display is erratic or all zeros, increase the 651B signal level until counting and display occurs.

d. Note the input signal level; obtain several ⅛ W 1% resistors ranging from 10K ohms down to 500 ohms. Starting with the 10K ohm resistor, connect these resistors, one at a time, in parallel with R16.

e. Reduce the input signal level until counting stops or is erratic. Note the input signal level.

f. Remove the parallel resistor and connect another resistor of lower value across R16.

g. Reduce the input signal level until counting stops or is erratic.

h. Repeat steps a through g until a display can no longer be obtained when the parallel resistor value is decreased.

i. At this point, increase the signal level and/or the parallel resistor value until counting and display occurs within specifications.

j. Calculate the effective resistance of R16 - Parallel resistor combination and install that value in place of R16.

k. The minimum specified input signal level for 5302A channel A is 50 mV rms (typical levels may be less than 50 mV).

l. Repeat steps a through k for channel B. Display for channel B should be 100.000 kHz C.

Table 9B-5-1. In-Cabinet Performance Checks

1. CHECK Mode

a. Ensure 5300A OSC switch is at INT.

b. Mate 5300A to 5302A and ensure side casting latches at rear of 5300A are latched.

c. Connect ac power to 5300A ac receptacle.

d. Turn ac power "on" with 5300A SAMPLE RATE slightly cw out of OFF.

e. Set FUNCTION to CHECK; TIME BASE switch has no effect. Display should be 10.0000 MHz ± 1 count.

2. FREQ A Mode

RANGE: 10 Hz to 50 MHz.

Obtain following test equipment:

HP 651B Test Oscillator
HP 3200B VHF Oscillator
HP 11048B Feed-thru Termination

Table 5-1 in the 5300A portion of the manual and Table 9-5-1 lists equipment used; equipment with equivalent characteristics may be used.

a. Connect 651B 50-Ohm OUTPUT through the 50-Ohm feed-thru to 5302A "A-50 MHz" connector. Set 5302A FUNCTION to FREQ A, "A Waveform" Switch to " ∿ " and "A" SENSITIVITY to full cw.

b. Set 651B or 3200B to frequencies and output levels listed below: Display should be as listed.

651B or 3200B OUTPUT mV rms	651B FREQ. Hz Approximate	TIME BASE (Sec)	Approximate Display ± 1 Count ± Accuracy of Source
50 mV	10 Hz	10	000.010 kHz C
50 mV	10 kHz	10	010.000 kHz C
50 mV	100 kHz	1	0.10000 MHz C
50 mV	1 MHz	.1	01.0000 MHz C
50 mV	10 MHz	.1	10.0000 MHz C
	3200B FREQ. MHz Approximate		
100 mV	20	AUTO	20.0000 MHz
100 mV	40	AUTO	40.0000 MHz
100 mV	50	AUTO	50.0000 MHz

Table 9B-5-1. In-Cabinet Performance Checks (Continued)

3. FREQ B Mode

RANGE: 10 Hz to 10 MHz

Obtain the following test equipment:

HP 651B Test Oscillator
HP 11048B 50-Ohm Feed-thru Termination.

Table 5-1 of the 5300A portion of the manual lists equipment used; equipment with equivalent characteristics may be used.

a. Connect the 651B, set to 50 mV rms, through the 50-Ohm Feed-thru to the 5302A B 10 MHz connector.

b. Set 5302A FUNCTION to FREQ B; "B" SENSITIVITY to full cw; "B" Waveform switch to "∿".

c. Set the 651B to frequencies listed below. Display should be as listed:

651B FREQ. Hz Approximate	TIME BASE (Sec)	Approximate Display ±1 Count ± Accuracy of Source
10 Hz	10	00.0100 kHz C
10 kHz	10	10.0000 kHz C
100 kHz	1	100.000 kHz C
1 MHz	.1	1.00000 MHz C
100 kHz	AUTO	100.000 kHz C
1 MHz	AUTO	1.00000 MHz C
10 MHz	AUTO	10.0000 MHz C

4. PULSE MEASUREMENTS Mode

Channel A and Channel B, "⎍" or "⎍" mode.

RANGE: 10 Hz to 1 MHz for Channel A. 10 Hz to 1 MHz for Channel B.

PULSE WIDTH: 50 nsec minimum.

Obtain the following test equipment:

HP Model 222A Pulse Generator
HP Model 11048B 50-Ohm Feed-thru Termination
HP Model 180A Oscilloscope
BNC Tee Connector.

a. Connect equipment as shown in Figure A.

b. Set 222A for "+" PULSE POLARITY; 50 nsec pulse width; 150 mV p-p (low duty cycle).

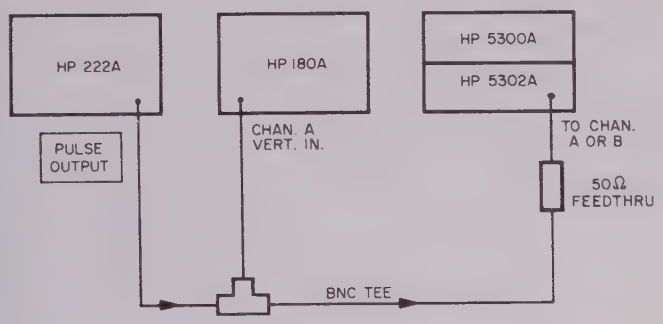
c. Monitor 222A pulse output with oscilloscope and set REP RATE for 10 Hz.

NOTE

For frequencies above 1 MHz slide switch S1 to "∿" position. A low duty cycle rate is required when making measurements in plus or minus pulse mode.

Table 9B-5-1. In-Cabinet Performance Checks (Continued)

Figure A. Connections for Pulse Measurements



d. Set 5302A SENSITIVITY to maximum ccw, Waveform Switch to "⎍", FUNCTION to FREQ A; TIME BASE to AUTO. Adjust SENSITIVITY cw until a stable display is obtained.

e. 5300A display should be approximately 10 Hz.

f. Repeat step d with 222A repetition rates of 10 kHz, 100 kHz, 1 MHz. The 5300A display should be the same as the 222A repetition rate setting.

g. Set 222A PULSE POLARITY to "-"; set Channel A Waveform switch to "⎍". Repeat steps b through f.

h. For Channel B, connect the pulse signal to Channel B 10 MHz connector; set FUNCTION to FREQ B.

i. Repeat steps b through g.

5. PERIOD B Mode

RANGE: 10 Hz (.1 sec) 1 MHz (1 μsec) Channel B only.

Obtain the following test equipment:

HP Model 651B Test Oscillator
HP Model 11048B 50-Ohm Feed-thru Termination
HP Model 180A Oscilloscope
BNC Tee Connector.

a. Connect equipment as shown in Figure B.

Figure B. Connections for Period B Measurements

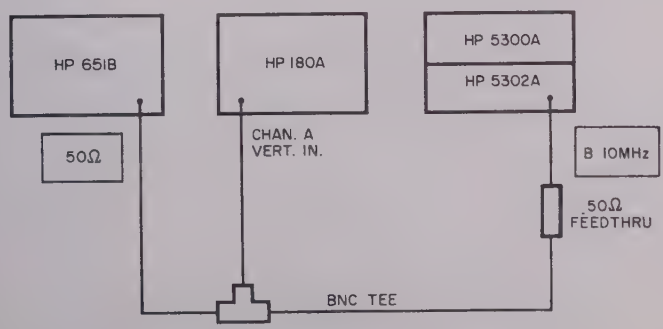


Table 9B-5-1. In-Cabinet Performance Checks (Continued)

b. Set 5302A controls as follows:

1. FUNCTION to PERIOD B.
2. TIME BASE to 1 μs.
3. Channel B Waveform Switch to " $\sim$ ".
4. Channel B SENSITIVITY to full ccw.

c. Monitor the oscilloscope and set 651B controls for 10 Hz, 100 mV rms output.

d. Adjust 5302A Channel B SENSITIVITY cw for a stable display; display should be approximately 100000 μs, C.

e. Monitor oscilloscope and set 651B for following frequencies: Display should be as listed.

651B	5300A/5302A
10 kHz	000100 μs
100 kHz	000010 μs
1 MHz	000001 μs

NOTE

For increase in resolution, adjust 5302A TIME BASE to .1 μsec.

6. TIME INTERVAL Mode

RANGE: 500 nsec to 1000 seconds.

Obtain the following test equipment:

HP Model 222A Pulse Generator (2 required).
HP Model 11048B 50-Ohm Feed-thru Termination (2 required).
HP Model 180A Oscilloscope.
BNC Tee Connectors, (3 required).

a. Connect equipment as shown in Figure C.

Figure C. Connections for Time Interval Measurements

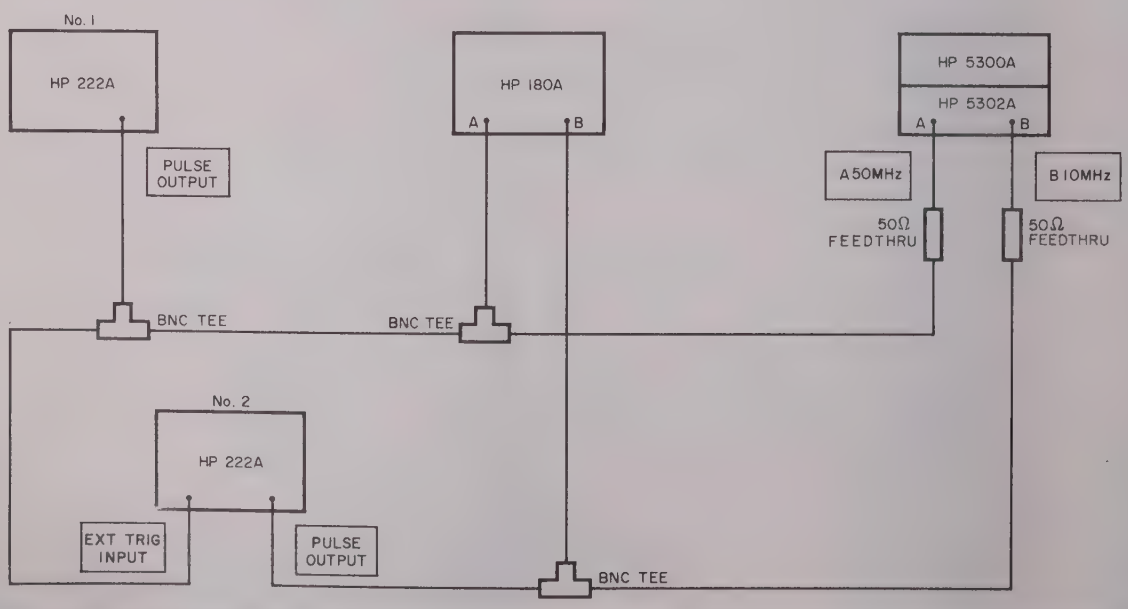


Table 9B-5-1. In-Cabinet Performance Checks (Continued)

b. While monitoring generator No. 1 output with oscilloscope, set No. 1 generator controls as follows:

1. REP RATE to 1k-10k with adjustment centered.
2. PULSE WIDTH for .2 μsec pulse at 5V amplitude.
3. PULSE POLARITY to +.

c. While monitoring generator No. 2 output with oscilloscope, set No. 2 generator controls as follows:

1. REP RATE to MAN/EXT +.
2. PULSE POLARITY to +.
3. PULSE WIDTH for .2 μsec pulse at 5V amplitude.
4. PULSE DELAY for .5 μsec.

d. Set Oscilloscope DISPLAY control to A + B to monitor No. 2 pulse position.

e. Set 5302A controls as follows:

1. SENSITIVITY (both channels) full cw.
2. Waveform switches (both channels) to "⎍".
3. FUNCTION to T.I. A to B.
4. TIME BASE to PERIOD/T.I. .1 μsec.

f. 5302A should display 00000.5 μsec ±1 count; verify time interval with oscilloscope while monitoring oscilloscope.

g. While monitoring oscilloscope, adjust No. 2 generator PULSE DELAY for time intervals from .5 μsec to 150 μsec. 5300A Display should be the same as oscilloscope display.

h. Set No. 1 generator REP RATE to 100-1k and adjustment centered.

i. While monitoring oscilloscope, adjust No. 2 generator PULSE DELAY for time intervals from 150 μsec to 2000 μsec. 5300A display should be the same as oscilloscope display.

j. Set No. 1 generator REP RATE to 10-100 and adjustment full ccw.

k. While monitoring oscilloscope, adjust No. 2 generator PULSE DELAY for time intervals from 2000 μsec to 6000 μsec. 5300A display and oscilloscope display should indicate the same time intervals.

NOTE

Measurement resolution may be adjusted from .1 μsec to 1 msec with the TIME BASE PERIOD/T.I. switch.

Table 9B-5-1. In-Cabinet Performance Checks (Continued)

7. **PERIOD AVG B Mode**

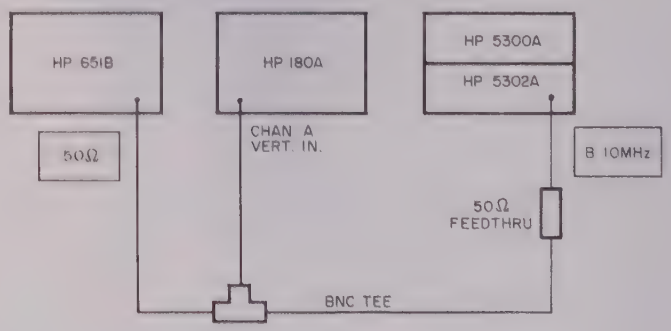
RANGE: 10 Hz (.1 sec) to 1 MHz (1 μsec).

Obtain the following test equipment:

HP Model 651B Test Oscillator.
HP Model 11048B 50-Ohm Feed-thru Termination.

a. Connect equipment as shown in Figure D.

Figure D. Connections for Period Average Measurements



b. Set 5302A controls as follows:

1. FUNCTION to PER AVG B.
2. Channel B Waveform switch to "∿ ".
3. Channel B SENSITIVITY to full ccw.

c. Monitor the oscilloscope and set 651B controls for 10 Hz, 100 mV rms output.

d. Adjust 5302A Channel B SENSITIVITY cw for a stable display; display should be approximately * 00.0000 M S C, (* = OVERFLOW) (100 msec).

e. Monitor the oscilloscope and set 651B for the following frequencies; display should be as listed.

651B	5300A/5302A
10 kHz	100.000 μs C
100 kHz	10.0000 μs C
1 MHz	01.0000 μs C

NOTE

Periods averaged automatically selected to provide maximum resolution.

Table 9B-5-1. In-Cabinet Performance Checks (Continued)

8. RATIO Measurements

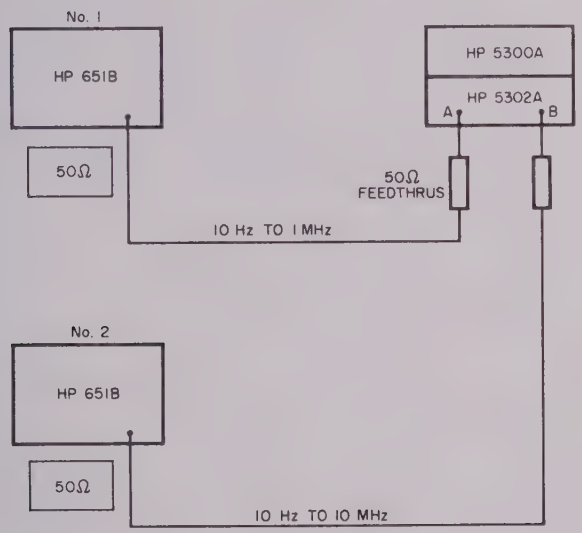
RANGE: Channel A: 10 Hz to 1 MHz.
Channel B: 10 Hz to 10 MHz.

Obtain the following test equipment:

HP Model 651B Test Oscillator (2 required).
HP Model 11048B 50-Ohm Feed-thru Termination (2 required).

a. Connect equipment as shown in Figure E.

Figure E. Ratio Measurement Equipment Connections



b. Set No. 1 oscillator to 10 Hz; verify frequency using Channel B of 5302A.

c. Set No. 2 oscillator to 10 Hz; verify frequency using Channel B of 5302A.

d. Set 5302A controls as follows:

1. Channel A: SENSITIVITY to full cw. Waveform switch to " ∿ ".
2. Channel B: SENSITIVITY to full cw. Waveform switch to " ∿ ".
3. FUNCTION to RATIO $\frac{B}{A}$ X N.
4. TIME BASE to N = 10 (white).

e. 5300A display should be 000010 C; divide display by "N" setting of 10. Ratio is 1:1.

f. Set No. 1 generator to 1 MHz and No. 2 generator to 10 MHz. Display should be 000100 C; divide display by "N" setting of 10. Ratio is 10:1.

NOTE

Ratio Multiplier setting may be set to 10 through 10^7. Measurement time is proportional to N.

Table 9B-5-1. In-Cabinet Performance Checks (Continued)

9. **Totalizing (OPEN/CLOSE B) Measurements**

Obtain the following test equipment:

HP Model 651B Test Oscillator.
HP Model 11048B 50-Ohm Feed-thru Termination.

a. Connect 651B 50-Ohm output, set to 10 Hz at 100 mV rms, to 5302A Channel B 10 MHz connector.

b. Set Channel B SENSITIVITY full ccw and set Channel B Waveform switch to "∿ ".

c. Set FUNCTION switch to OPEN/CLOSE B.

d. TIME BASE switch may be in any position since it is inoperative in Totalizing mode. Instrument gate is controlled by operator when OPEN/CLOSE B pushbutton is pressed.

e. Press OPEN/CLOSE B switch; 5300A C lamp will turn on; adjust Channel B SENSITIVITY cw until 5300A display starts accumulating.

f. To stop 5300A from accumulating, press OPEN/CLOSE B. To continue accumulation from the number displayed press OPEN/CLOSE B, otherwise press RESET to clear display.

PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 5300A/5302A
50 MHz Universal Counter

Test Performed by _____

Serial No. ____-_____

Date _____

Description	Check
1. CHECK Mode. Display is 10 MHz ±1 Count.	☐
2. FREQ A Mode. 10 Hz to 50 MHz.	☐
3. FREQ B Mode. 10 Hz to 10 MHz.	☐
4. PULSE MEASUREMENTS Mode. Channel A and B; "⌐¬", "¬⌐" 10 Hz to 1 MHz Channel A. "⌐¬", "¬⌐" 10 Hz to 1 MHz Channel B.	☐ ☐
5. PERIOD B Mode. 10 Hz (.1 sec) to 1 MHz (1 μsec).	☐
6. TIME INTERVAL Mode. 500 nsec to 1000 seconds (tested to 6000 μsec).	☐
7. PER AVG B Mode. 10 Hz (.1 sec) to 1 MHz (1 μsec).	☐
8. RATIO Mode. Channel A. 10 Hz to 1 MHz. Channel B. 10 Hz to 10 MHz.	☐
9. Totalizing (OPEN/CLOSE B) Controlled accumulation.	☐

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

TP1	H	Pulses Low when Time Base switch position "rocked".
TP2	H	Pulses Low when Time Base switch position "rocked".
TP3	H	Pulses Low when Function switch changed to FREQ B.
TP4	H	Goes Low when Function switch changed from FREQ A.
TP5	H	Pulses Low when Time Base switch is "rocked".
TP6	L	Pulses High when Function switch is "rocked".
TP7	L	Pulses High when Function switch is "rocked".
TP8	H (Dim)	Pulsing Low at a .1 second rate. Pulse rate decreases as Time Base switch is changed.
TP9	H	Pulses Low at a .1 second rate. Pulse rate decreases as Time Base switch is changed.
TP10	H	
TP11	L	
TP12	H	

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using an HP 651B Oscillator as signal source. Oscillator set to 10 MHz, 100 mVrms/50Ω. See Paragraph 9B-5-16.

1A .005 V/cm, 1 μsec/cm Sens. Max. cw.

1B .005 V/cm, .1 μsec/cm. Sens. Max. ccw.

3 .01 V/cm, .1 μsec/cm.

2 .02 V/cm, .1 μsec/cm.

4 .02 V/cm, .5 μsec/cm.

5 .1 V/cm, 20 msec/cm, dc coupled, – slope.

6 .2 V/cm, 20 msec/cm, dc coupled.

7 .1 V/cm, 20 msec/cm, dc coupled, – slope.

8 .1 V/cm, .1 μsec/cm, dc coupled.

9 1 V/cm, .1 μsec/cm, dc coupled, (5300 Sample Rate Max. cw).

10 .1 V/cm, .1 μsec/cm, dc coupled.

11 .1 V/cm, .5 μsec/cm, dc coupled, (5300 Sample Rate Max. cw).

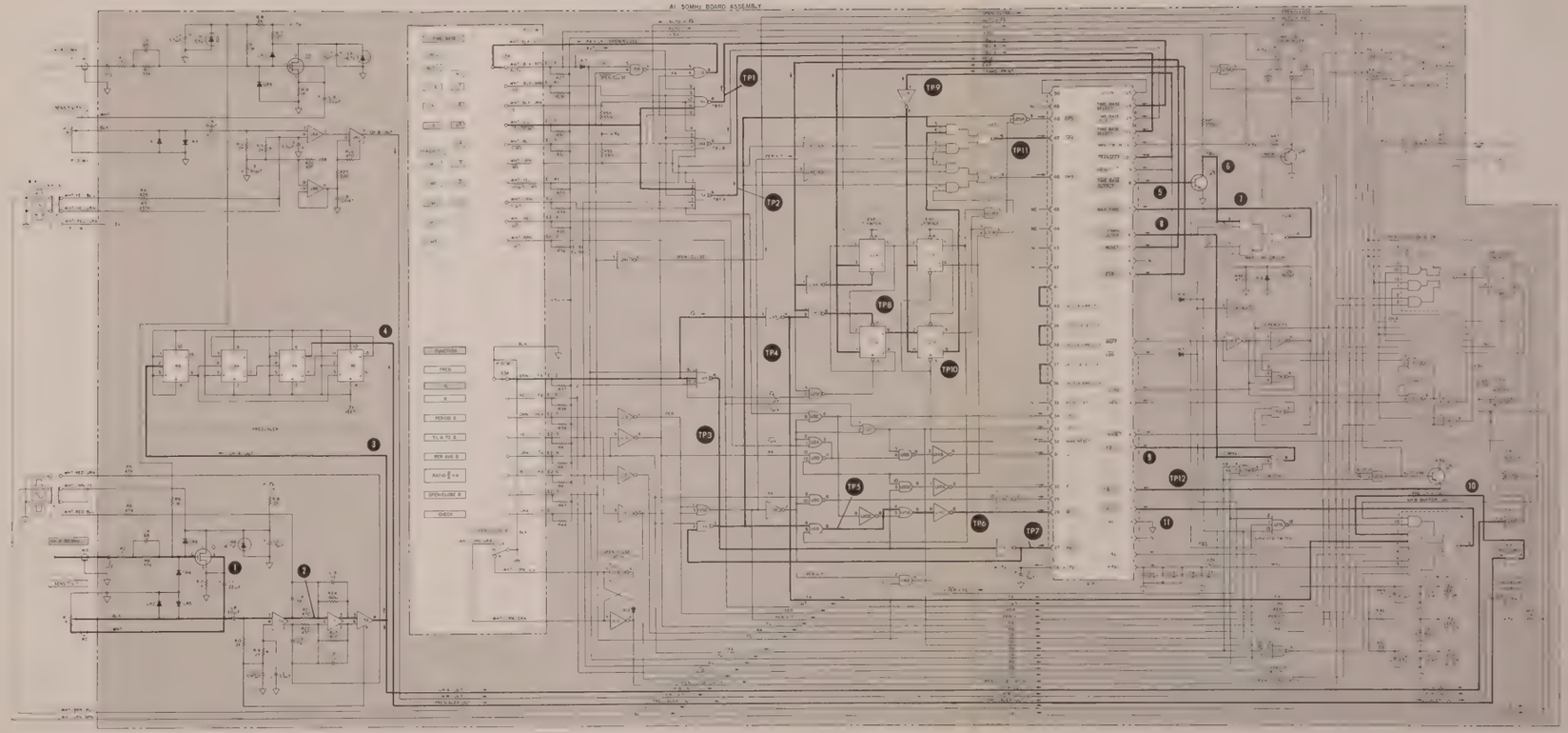


Figure 9B-5-2
FREQ A MODE TROUBLESHOOTING CHART
9B-5-15

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

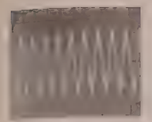
TP1	H	Pulses Low when Time Base switch is "rocked".
TP2 TP3 TP4	H	Pulses Low or goes Low when Time Base switch is "rocked".
TP5 TP6	L	Pulses High or goes High when Time Base switch is "rocked".
TP7	H	Pulses Low at a .1 second rate. Pulse rate may be varied by adjusting 5300 Sample Rate.
TP8	L	Pulses High at a .1 second rate. Pulse rate may be varied by adjusting 5300 Sample Rate.
TP9	L	Pulses High at a .1 second rate.
TP10 TP11	H	Pulses Low when 5300 RESET is pressed.
TP12	L	Pulses High when 5300 RESET is pressed.
TP13	H	

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; - slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using an HP651B Oscillator as signal source. Oscillator set to 10 MHz, 100 mVrms, 50Ω. See Paragraph 9B-5-15.



1A .005 V/cm, 1 μsec/cm, Sens. Max. ccw

1B .005 V/cm, .1 μsec/cm, Sens. Max. cw.

2 .02 V/cm, .1 μsec/cm

3 .1 V/cm, .1 μsec/cm, dc coupled.

4 .1 V/cm, .1 μsec/cm, dc coupled.

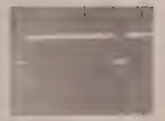
5 .1 V/cm, .1 μsec/cm, dc coupled, 5300 Sample Rate Max. cw.

6 .2 V/cm, .1 μsec/cm, dc coupled.

7 .2 V/cm, .1 μsec/cm, dc coupled, 5300 Sample Rate Max. cw.

8 .2 V/cm, 20 msec/cm, dc coupled, – slope.

9 .2 V/cm, 20 msec/cm, dc coupled.



10 .2 V/cm, 20 msec/cm, dc coupled, – slope.

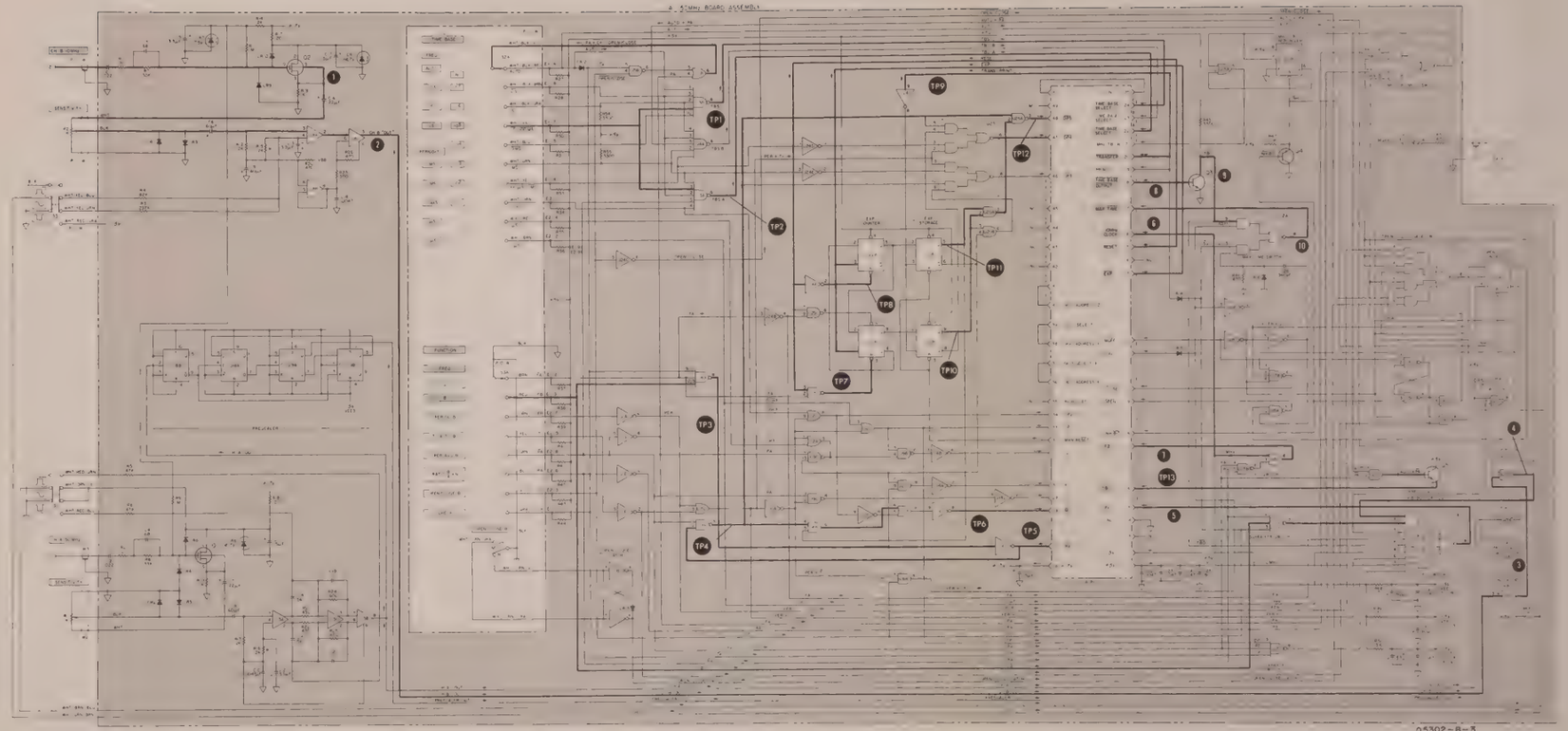


Figure 9B-5-3
FREQ B MODE TROUBLESHOOTING CHART
9B-5-17

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

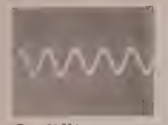
TP1	H	Pulses Low or goes Low when FUNCTION switch is "rocked".
TP2	L	Pulses High or goes High when FUNCTION switch is "rocked".
TP3	L	Pulses High or goes High when FUNCTION switch or TIME BASE switch is "rocked".
TP4	L	Pulses High or goes High when FUNCTION switch is "rocked".
TP5 TP6	H (Dim)	Rapid flashing indicates presence of signal.
TP7	H	
TP8 TP9 TP10	H (Dim)	Flash rate may be decreased by adjusting 5300 Sample Rate.

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using an HP 651B Oscillator as signal source. Oscillator set to 1 MHz, 100 mVrms/50Ω. See Paragraph 9B-5-20.



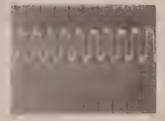
1 .01 V/cm, .5 μsec/cm.

2 .02 V/cm, .5 μsec/cm.

3 .1 V/cm, .5 μsec/cm.

4 .1 V/cm, .5 μsec/cm.

5 .2 V/cm, .1 μsec/cm, dc coupled.



6 .2 V/cm, .1 μsec/cm, dc coupled.

7 .2 V/cm, .2 μsec/cm, dc coupled, – slope.

8 .2 V/cm, 5 μsec/cm, dc coupled.

9A .2 V/cm, .2 μsec/cm, dc coupled.

9B .2 V/cm, 5 msec/cm, dc coupled.

10A .2 V/cm, 2 μsec/cm, dc coupled, – slope.

10B .2 V/cm, 5 msec/cm, dc coupled, – slope.

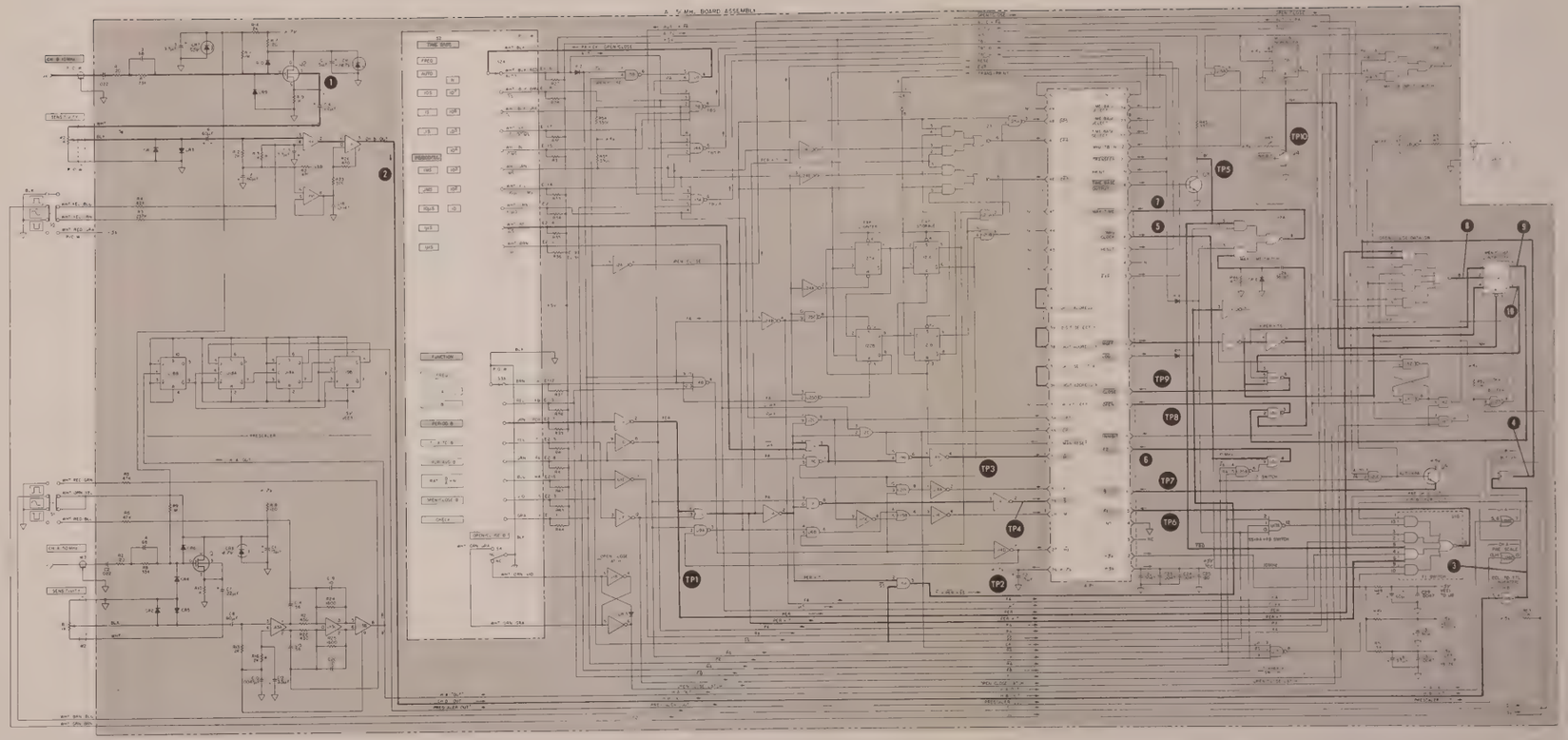


Figure 9B-5-4
PERIOD B MODE TROUBLESHOOTING CHART
9B-5-19

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

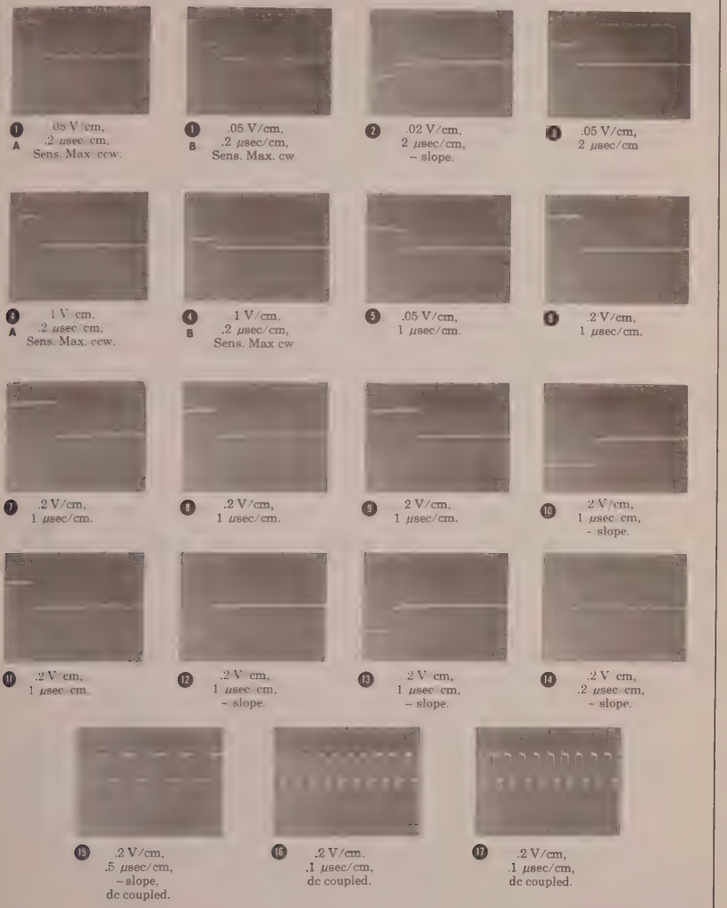
TP1	L	
TP2	L	Goes High when FUNCTION switch set to PER AVG B.
TP3	L	Goes High when FUNCTION switch set to PER AVG B or when TIME BASE set to 10 μsec.
TP4	H	Pulses Low or goes Low when FUNCTION switch is "rocked".
TP5	L	Pulses High or goes High when FUNCTION switch is "rocked".
TP6	L	Pulses High or goes High when FUNCTION switch is "rocked". Goes High when TIME BASE switch is "rocked".
TP7	L	Pulses High or goes High when FUNCTION switch or when TIME BASE switch is "rocked".
TP8	L	Pulses High when FUNCTION switch is "rocked".
TP9	H (Dim)	Flash-on rate may be decreased by adjusting 5300 Sample Rate.
TP10	H (Dim)	Flash-on rate may be decreased by adjusting 5300 Sample Rate.
TP11 TP12 TP13	H (Dim)	Flash-on rate may be decreased by adjusting 5300 Sample Rate.
TP14	H	

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using HP 222A Pulse Generators as signal sources. See Paragraph 9B-5-22.


1 A .05 V/cm, .2 μsec/cm, Sens. Max. ccw.
1 B .05 V/cm, .2 μsec/cm, Sens. Max. cw
2 .02 V/cm, 2 μsec/cm, – slope.
3 .05 V/cm, 2 μsec/cm
4 A 1 V/cm, .2 μsec/cm, Sens. Max. ccw.
4 B 1 V/cm, .2 μsec/cm, Sens. Max cw
5 .05 V/cm, 1 μsec/cm.
6 .2 V/cm, 1 μsec/cm.
7 .2 V/cm, 1 μsec/cm.
8 .2 V/cm, 1 μsec/cm.
9 .2 V/cm, 1 μsec/cm.
10 .2 V/cm, 1 μsec/cm, – slope.
11 .2 V/cm, 1 μsec/cm.
12 .2 V/cm, 1 μsec/cm, – slope.
13 .2 V/cm, 1 μsec/cm, – slope.
14 .2 V/cm, .2 μsec/cm, – slope.
15 .2 V/cm, .5 μsec/cm, – slope, dc coupled.
16 .2 V/cm, .1 μsec/cm, dc coupled.
17 .2 V/cm, .1 μsec/cm, dc coupled.

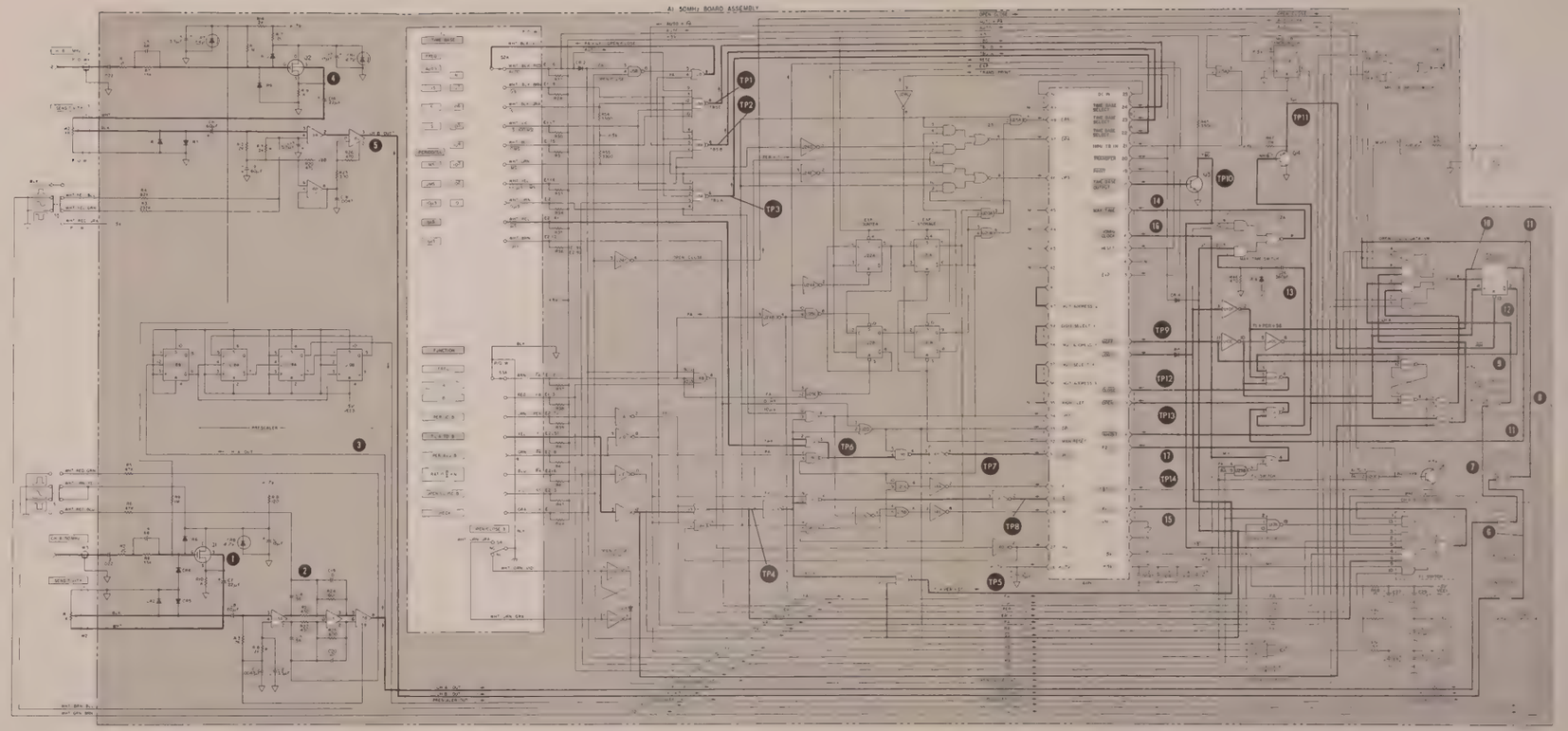


Figure 9B-5-5
TIME INTERVAL A TO B MODE
TROUBLESHOOTING CHART
9B-5-21

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

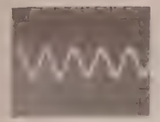
TP1	H	Flashes Low when FUNCTION switch is "rocked".
TP2, TP3	H	Goes Low when FUNCTION switch is "rocked".
TP4, TP5, TP6, TP7	H (Dim)	Flash-on rate may be decreased by adjusting 5300 Sample Rate.
TP8, TP9, TP10, TP11	L	
TP12	H	Goes Low when FUNCTION switch is "rocked".
TP13	L	Flashes High when FUNCTION switch is "rocked".

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using an HP 651B Oscillator as signal source. See Paragraph 9B-5-24.



1 .01 V/cm, .5 μsec/cm.

2 .02 V/cm, .5 μsec/cm.

3 .1 V/cm, .5 μsec/cm.

4 .1 V/cm, .5 μsec/cm.

5 1 V/cm, .1 μsec/cm.

6 .1 V/cm, .1 μsec/cm.

7 A .1 V/cm, .5 msec/cm, dc coupled, – slope.

7 B .1 V/cm, 5 msec/cm, dc coupled, – slope.

8 A .1 V/cm, .1 msec/cm, dc coupled, – slope.

8 B .1 V/cm, 5 msec/cm, dc coupled, – slope.

9 .1 V/cm, 1 μsec/cm, dc coupled.

10 .2 V/cm, 5 msec/cm, dc coupled, – slope.

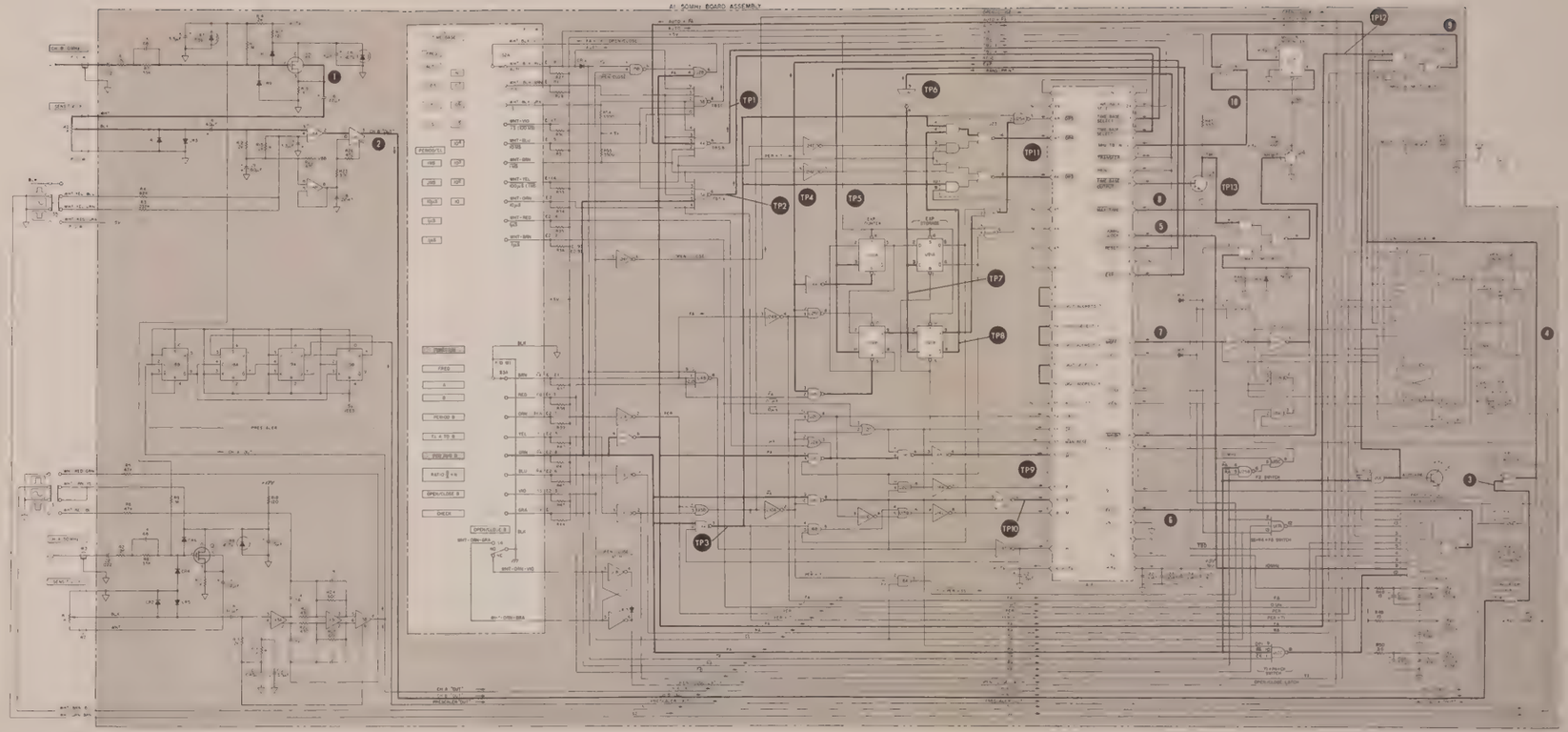


Figure 9B-5-6
PERIOD AVERAGE B MODE TROUBLESHOOTING CHART

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

TP1	H	Goes Low when TIME BASE switch is "rocked". Goes Low or pulses Low when FUNCTION switch is "rocked".
TP2	H	Pulses Low or goes Low when TIME BASE switch is "rocked".
TP3, TP4	H (Dim)	Flash rate may be decreased by adjusting 5300 Sample rate. Goes Low when 5300 RESET is pressed.
TP5	H	

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

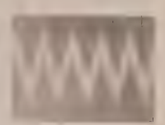
5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope using an HP 651B Oscillator as signal source. See Paragraph 9B-5-26.

1A .01 V/cm, 1 μsec/cm, 5300 Sample Rate ccw.

1B .01 V/cm, 1 μsec/cm, 5300 Sample Rate cw.

2 .02 V/cm, 1 μsec/cm.



3 .005 V/cm, .5 μsec/cm.

4 .02 V/cm, 1 μsec/cm.

5 .02 V/cm, .5 μsec/cm.

6 .1 V/cm, .5 μsec/cm.

7 .1 V/cm, .1 μsec/cm.

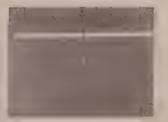
8 .1 V/cm, .1 μsec/cm.

9 .1 V/cm, .5 μsec/cm.

10 .1 V/cm, .5 μsec/cm.

11 .1 V/cm, .1 μsec/cm.

12A .2 V/cm, 1 msec/cm, dc coupled, – slope.



12B .2 V/cm, 5 msec/cm, dc coupled, – slope.

13A .2 V/cm, .1 msec/cm, dc coupled, – slope.

13B .2 V/cm, 5 msec/cm, dc coupled, – slope.

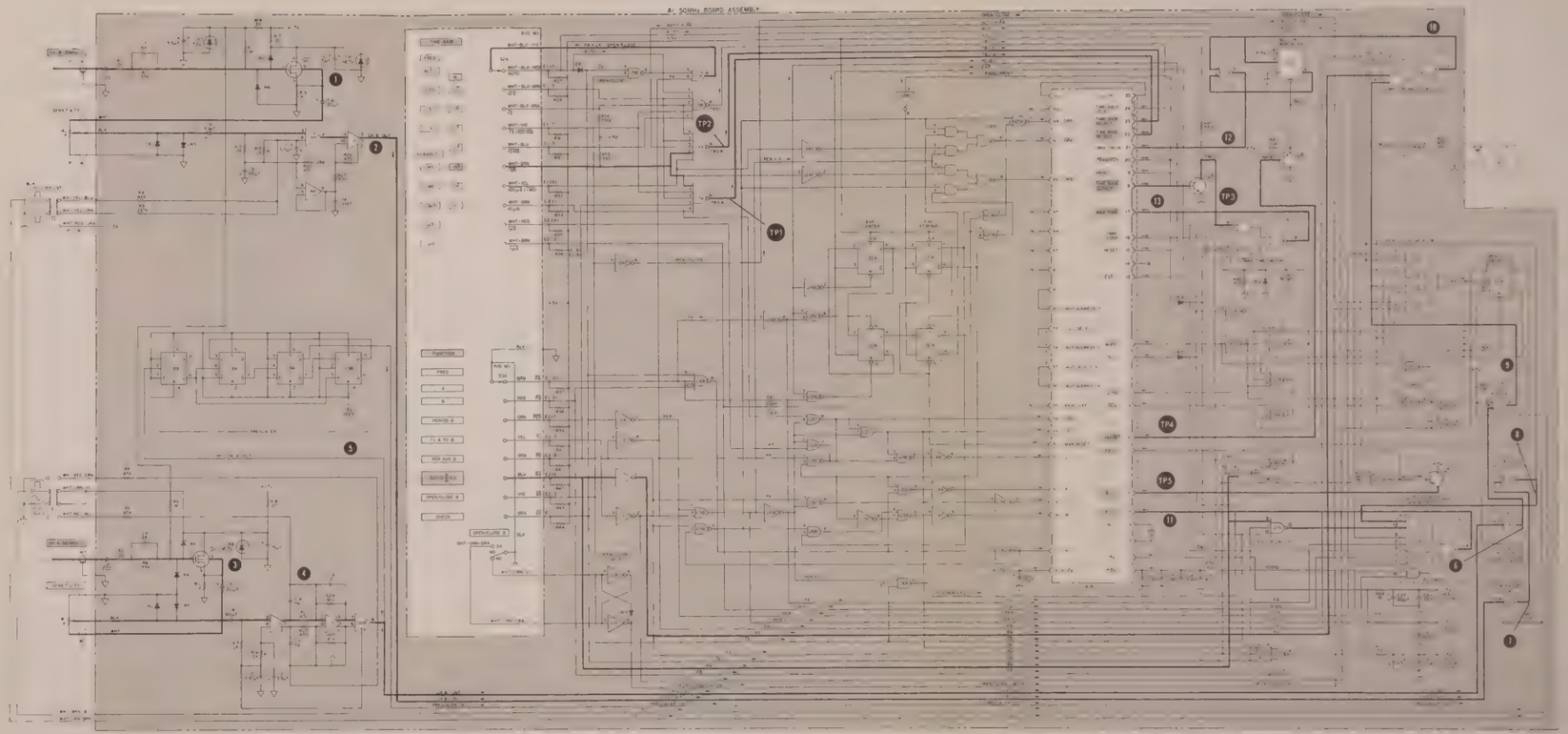


Figure 9B-5-7
RATIO MODE TROUBLESHOOTING CHART

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

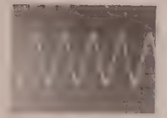
TP1	L	Flashes High whenever OPEN/CLOSE switch is pressed.
TP2	H	Flashes Low whenever 5300 RESET is pressed.
TP3	H	Flashes Low whenever OPEN/CLOSE switch is pressed.
TP4		High whenever counter is accumulating. Low when counter is not accumulating.
TP5		Low whenever counter is accumulating; High when counter is not accumulating.
TP6	H	Flashes Low when count is initiated.
TP7	H	Flashes Low when count is terminated or when 5300 RESET is pressed.
TP8	L	

OSCILLOSCOPE:

All waveforms ac coupled (except where noted) through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

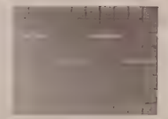
Separated from casting. Waveforms taken with 180A Oscilloscope using an HP 651B Oscillator as signal source. See Paragraph 9B-5-28.



1 .005 V/cm,
50 msec/cm,
Sens. cw.

2 .05 V/cm,
20 msec/cm,
dc coupled.

3 .2 V/cm,
20 msec/cm,
dc coupled.



4 .2 V/cm,
20 msec/cm,
dc coupled.

5 .1 V/cm,
20 msec/cm,
dc coupled.

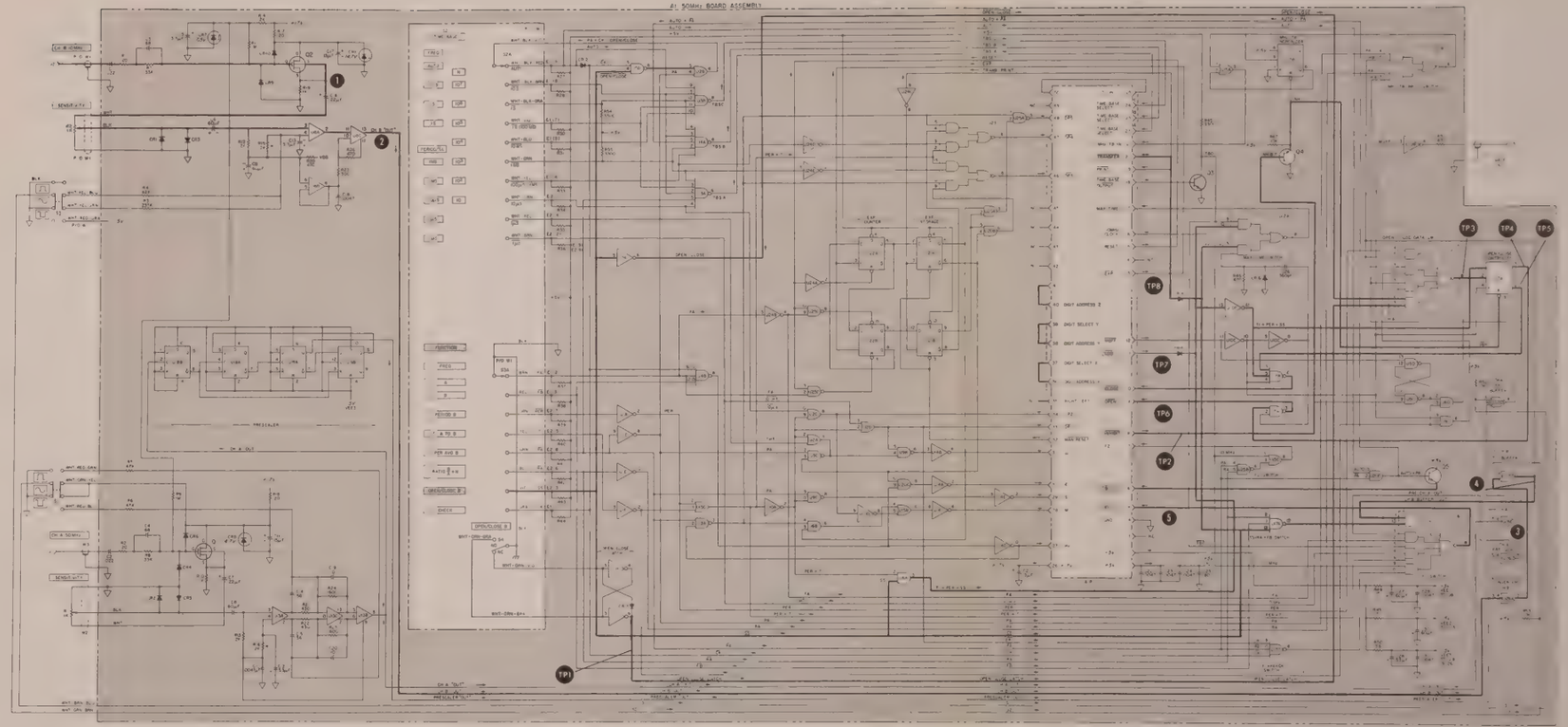


Figure 9B-5-8
OPEN/CLOSE (TOTALIZE) MODE TROUBLESHOOTING CHART
9B-5-27

TEST POINTS USING HP 10525A LOGIC PROBE

H = High (lamp on)
L = Low (lamp off)

TP1, TP2	H	Goes Low when FUNCTION switch is switched out of CHECK.
TP3	H (Dim)	Goes Low when 5300 RESET is pressed.
TP4	H	
TP5	L	Goes High when FUNCTION switch is switched out of CHECK.
TP6	L	Goes High when 5300 RESET is pressed.
TP7	L	
TP8	H	Goes Low when FUNCTION switch is switched out of CHECK.
TP9	H (Dim)	Goes Low when 5300 RESET is pressed.
TP10	H (Dim)	Goes High (bright) when 5300 RESET is pressed.
TP11	L	Goes High (Dim) when FUNCTION switch is switched out of CHECK.

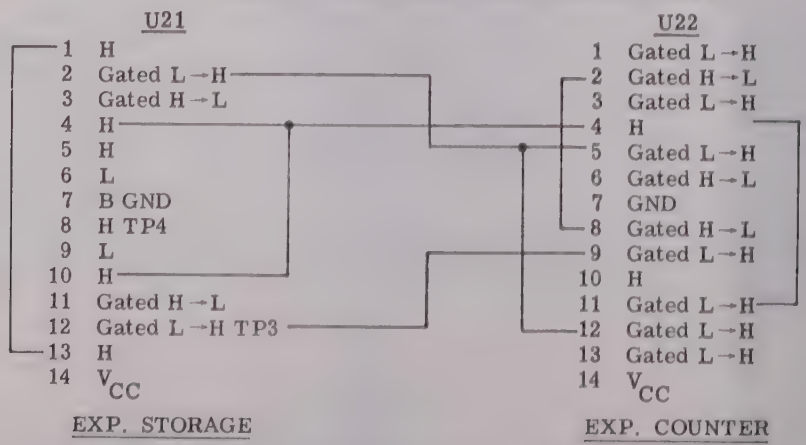
OSCILLOSCOPE:

All waveforms dc coupled through a 10:1 divider probe; + slope (except where noted), INT triggering.

5302A:

Separated from casting. Waveforms taken with 180A Oscilloscope. See Paragraph 9B-5-30.

LOGIC CONDITIONS IN SELF CHECK MODE



All gated conditions represents frequency = 1 MHz approximately.

1 .2 V/cm, .1 μsec/cm.

2 .2 V/cm, .1 μsec/cm.

3 .2 V/cm, .1 μsec/cm, 5300 Sample Rate ew.

4 .1 V/cm, 20 msec/cm, – slope.

5 .2 V/cm, 20 msec/cm, – slope.

6 .2 V/cm, .5 μsec/cm, –slope.

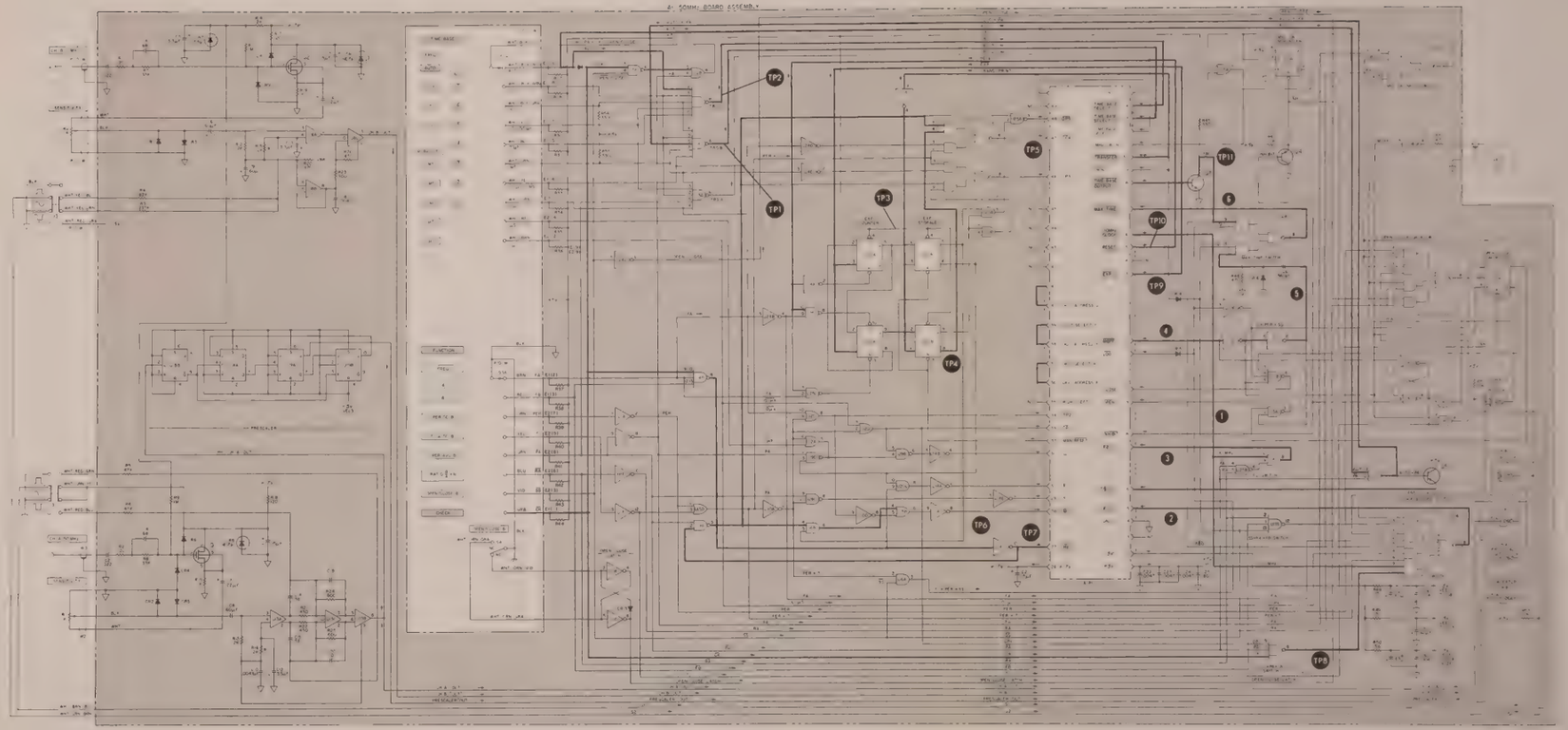


Figure 9B-5-9
SELF CHECK MODE TROUBLESHOOTING CHART

SECTION IX B
5302A 50 MHz UNIVERSAL COUNTER
SUBSECTION VI
REPLACEABLE PARTS

9B-6-1. INTRODUCTION

9B-6-2. This subsection contains information for ordering replacement parts. Table 9A-6-1 lists parts used in the HP 5302A. The table lists parts in alpha-numerical order of their reference designators and provides the following information on each part:

a. Hewlett-Packard part number.

b. Description of part (see abbreviations below).

c. Total quantity used in the instrument (the first time the part appears in the list, the total quantity of that part number is printed).

d. Typical manufacturers of the part in a five-digit code (see list of manufacturers in Table 9B-6-2). Manufacturer's part number (miscellaneous parts are listed at the end of Table 9B-6-1).

9B-6-3. ORDERING INFORMATION

9B-6-4. To obtain replacement parts address order or inquiry to your local Hewlett-Packard Sales and Service Office (see lists in Section VI, 5300A manual for addresses). Identify parts by their Hewlett-Packard part number. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

A	assembly	F	fuse	MP	mechanical part	U	integrated circuit
B	motor	FL	filter	P	plug	V	vacuum, tube, neon bulb, photocell, etc.
BT	battery	IC	integrated circuit	Q	transistor		
C	capacitor	J	jack	R	resistor	VR	voltage regulator
CP	coupler	K	relay	RT	thermistor	W	cable
CR	diode	L	inductor	S	switch	X	socket
DL	delay line	LS	loud speaker	T	transformer	Y	crystal
DS	device signaling (lamp)	M	meter	TB	terminal board	Z	tuned cavity, network
E	misc electronic part	MK	microphone	TP	test point		

ABBREVIATIONS

A	amperes	H	henries	N/O	normally open	RMO	rack mount only
AFC	automatic frequency control	HDW	hardware	NOM	nominal	RMS	root-mean square
AMPL	amplifier	HEX	hexagonal	NPO	negative positive zero (zero temperature coefficient)	RWV	reverse working voltage
		HG	mercury				
BFO	beat frequency oscillator	HR	hour(s)			S-B	slow-blow
BE CU	beryllium copper	HZ	hertz	NPN	negative-positive-negative	SCR	screw
BH	binder head					SE	selenium
BP	bandpass	IF	intermediate freq	NRFR	not recommended for field replacement	SECT	section(s)
BRS	brass	IMPG	impregnated			SEMICON	semiconductor
BWO	backward wave oscillator	INCD	incandescent	NSR	not separately replaceable	SI	silicon
		INCL	include(s)			SIL	silver
CCW	counter-clockwise	INS	insulation(ed)	OBD	order by description	SL	slide
CER	ceramic	INT	internal	OH	oval head	SPG	spring
CMO	cabinet mount only	K	kilo - 1000	OX	oxide	SPL	special
COEF	coefficient					SST	stainless steel
COM	common	LH	left hand	P	peak	SR	split ring
COMP	composition	LIN	linear taper	PC	printed circuit	STL	steel
COMPL	complete	LK WASH	lock washer	PF	picofarads - 10^{-12} farads	TA	tantalum
CONN	connector	LOG	logarithmic taper			TD	time delay
CP	cadmium plate	LPF	low pass filter	PH BRZ	phosphor bronze	TGI	toggle
CRT	cathode-ray tube			PHL	Phillips	THD	thread
CW	clockwise	M	milli = 10^{-3}	PIV	peak inverse voltage	TI	titanium
		MEG	meg = 10^{6}	PNP	positive-negative-positive	TOL	tolerance
DEPC	deposited carbon	MET FLM	metal film			TRIM	trimmer
DR	drive	MET OX	metallic oxide	P/O	part of	TWT	traveling wave tube
ELECT	electrolytic	MFR	manufacturer	POLY	polystyrene	U	micro - 10^{-6}
ENCAP	encapsulated	MHZ	mega hertz	PORC	porcelain		
EXT	external	MINAT	miniature	POS	position(s)	VAR	variable
F	farads	MOM	momentary	POT	potentiometer	VDCW	dc working volts
FH	flat head	MOS	metal ozide substrate	PP	peak-to-peak		
FIL H	fillister head	MTG	mounting	PT	point	W	with
FXD	fixed	MY	"mylar"	PWV	peak working voltage	W	watts
						WIV	working inverse voltage
G	giga (10^{9})	N	nano (10^{-9})	RECT	rectifier		
GE	germanium	N/C	normally closed	RF	radio frequency	WW	wirewound
GL	glass	NE	neon	RH	round head or right hand	W/O	without
GRD	ground(ed)	NI PL	nickel plate				

01194-14

Table 9B-6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05302-60001	1	BOARD ASSY: 50 MHz (NOT AVAILABLE FOR FIELD REPLACEMENT OR SALE)	28480	05302-60001
A1C1	0170-0043	2	C:FXD MY 0.022UF 10% 400VDCW	28480	0170-0043
A1C2	0170-0043		C:FXD MY 0.022UF 10% 400VDCW	28480	0170-0043
A1C3	0140-0192	2	C:FXD MICA 68 PF 5%	28480	0140-0192
A1C4	0140-0192		C:FXD MICA 68 PF 5%	28480	0140-0192
A1C5	0180-0210	4	C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C6	0180-0106	5	C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C7	0180-0228	2	C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C8	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C9	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C10	0150-0075	7	C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C11	0180-1746	3	C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A1C12	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C13	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C14	0140-0191	4	C:FXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A1C15	0140-0191		C:FXD MICA 56 PF 5% 300VDCW	19701	RDM15E560J 300V
A1C16	0180-0228		C:FXD ELECT 22 UF 10% 15VDCW	56289	150D226X9015B2-DYS
A1C17	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A1C18	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C19	0160-2197	2	C:FXD MICA 10 PF 5%	28480	0160-2197
A1C20	0160-2197		C:FXD MICA 10 PF 5%	28480	0160-2197
A1C21	0180-1746		C:FXD ELECT 15 UF 10% 20VDCW	28480	0180-1746
A1C22	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C23	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C24	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C25	0180-1702	1	C:FXD ELECT 180 UF 20% 6VDCW	56289	150D187X0006R2-DYS
A1C26	0160-2209	1	C:FXD MICA 360 PF 5%	72136	RDM15F361J3C
A1C27	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C28	0180-0210		C:FXD ELECT 3.3 UF 20% 15VDCW	56289	150D335X0015A2-DYS
A1C29	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1C30	0180-0106		C:FXD ELECT 60 UF 20% 6VDCW	28480	0180-0106
A1C31	0150-0075		C:FXD CER 4700 PF +100-20% 500VDCW	72982	851-000-X5U0-472Z
A1CR1	1901-0040	8	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR4	1901-0044	4	DIODE:SILICON 20MA/1V	28480	1901-0044
A1CR5	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR6	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A1CR7	1902-0064	1	DIODE BREAKDOWN:7.5V	28480	1902-0064
A1CR8	1902-3203	2	DIODE BREAKDOWN:SILICON 14.7V 5%	28480	1902-3203
A1CR9	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A1CR10	1901-0044		DIODE:SILICON 20MA/1V	28480	1901-0044
A1CR11	1902-3203		DIODE BREAKDOWN:SILICON 14.7V 5%	28480	1902-3203
A1CR12	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR13	1910-0034	1	DIODE:GERMANIUM 25V	28480	1910-0034
A1CR14	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR15	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1CR16	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1E1	1810-0041	2	R:NETWORK,8 RES. 2.7K OHM 5%	28480	1810-0041
A1E2	1810-0041		R:NETWORK,8 RES. 2.7K OHM 5%	28480	1810-0041
A1P1	1251-2756	1	CONNECTOR:R & P, 50 CONTACT	74868	57-20500-31
A1Q1	1855-0306	2	TSTR:SI FET	80131	3N128
A1Q2	1855-0306		TSTR:SI FET	80131	3N128
A1Q3	1854-0009	2	TSTR:SI NPN	80131	2N709
A1Q4	1853-0015	1	TSTR:SI PNP	28480	1853-0015
A1Q5	1854-0009		TSTR:SI NPN	80131	2N709
A1R1	0683-1215	4	R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215
A1R2	0683-1215		R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215
A1R3	0698-3266	1	R:FXD MET FLM 237K OHM 1% 1/8W	28480	0698-3266
A1R4	0757-0970	1	R:FXD FLM 82K OHM 2% 1/8W	28480	0757-0970
A1R5	0757-0964	2	R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A1R6	0757-0964		R:FXD FLM 47K OHM 2% 1/8W	28480	0757-0964
A1R7	0761-0079	2	R:FXD MET OX 33K OHM 5% 1W	28480	0761-0079
A1R8	0761-0079		R:FXD MET OX 33K OHM 5% 1W	28480	0761-0079
A1R9	0683-1055	2	R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R10	0683-1025	2	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A1R11	0683-1055		R:FXD COMP 1 MEGOHM 5% 1/4W	01121	CB 1055
A1R12	0757-0283	4	R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R13	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W	28480	0757-0283
A1R14	0683-2025	1	R:FXD COMP 2000 OHM 5% 1/4W	01121	CB 2025
A1R15	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W FAC SEL	28480	0757-0283
A1R16	0757-0283		R:FXD MET FLM 2.00K OHM 1% 1/8W FAC SEL	28480	0757-0283
A1R17	0683-1215		R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215
A1R18	0683-1215		R:FXD COMP 120 OHM 5% 1/4W	01121	CB 1215
A1R19	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025

See introduction to this section for ordering information

Table 9B-6-1. Replaceable Parts (Continued)

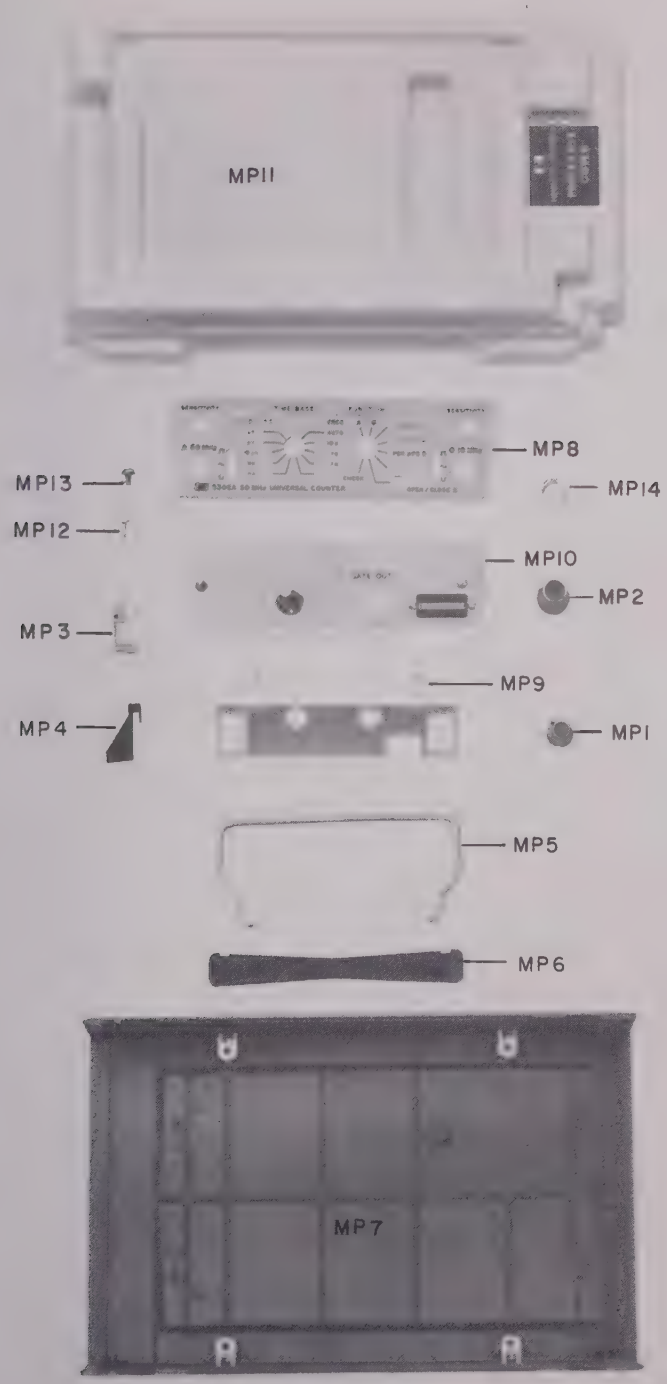
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R20	0683-4715	3	R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R21	0683-4315	2	R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A1R22	0683-4315		R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A1R23	0698-3114	1	R:FXD COMP 300 OHM 5% 1/8W	28480	0698-3114
A1R24	0683-1625	2	R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A1R25	0683-1625		R:FXD COMP 1600 OHM 5% 1/4W	01121	CB 1625
A1R26	0698-6984	1	R:FXD COMP 470 OHM 5% 1/8W	28480	0698-6984
A1R27, 28, 30			LOCATED IN A1E1 and A1E2		
A1R31 thru A1R44			LOCATED IN A1E1 and A1E2		
A1R29, R32			NOT ASSIGNED		
A1R45	0683-3325	3	R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1R46	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R47	0683-1035	1	R:FXD COMP 10K OHM 5% 1/4W	01121	CB 1035
A1R48	0683-1505	2	R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505
A1R49	0683-1505		R:FXD COMP 15 OHM 5% 1/4W	01121	CB 1505
A1R50	0683-0365	1	R:FXD COMP 3.6 OHM 5% 1/4W	01121	CB-3G5
A1R51	0683-4715		R:FXD COMP 470 OHM 5% 1/4W	01121	CB 4715
A1R52	0698-5426	2	R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A1R53	0698-5426		R:FXD COMP 10K OHM 10% 1/8W	28480	0698-5426
A1R54	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1R55	0683-3325		R:FXD COMP 3300 OHM 5% 1/4W	01121	CB 3325
A1U1	1820-0307	1	IC:DTL HEX INVERTER	07263	U6A993659X
A1U2	1820-0274	1	IC:DTL QUAD 2-INPT OR GATE	28480	1820-0274
A1U3	1820-0441	2	IC:DUAL 5-INPUT NAND GATE	04713	SC8171PK
A1U4	1820-0441		IC:DUAL 5-INPUT NAND GATE	04713	SC8171PK
A1U5	1820-0054	2	IC:TTL QUAD 2-INPUT NAND GATE	01295	SN4342
A1U6	1820-0511	2	IC:TTL QUAD 2-INPT & GATE	01295	SN20572
A1U7	1820-0281	1	IC:DIGITAL DUAL J-K MASTER SLAVE F/F	28480	1820-0281
A1U8	1820-0253	2	INTEGRATED CIRCUIT:DIGITAL ECL DUAL	04713	MC1035P
A1U9	1820-0094	1	IC:DTL QUAD 2-INPUT NAND NOR GATE	07263	U6A994659X
A1U10	1820-0174	2	INTEGRATED CIRCUIT:TTL HEX INVERTER	01295	SN8199
A1U11	1820-0084	1	INTEGRATED CIRCUIT:TTL	28480	1820-0084
A1U12	1820-0590	1	IC:DIGITAL TTL DUAL 2-WIDE, INPT AND/OR	28480	1820-0590
A1U13	1820-0253		INTEGRATED CIRCUIT:DIGITAL ECL DUAL	04713	MC1035P
A1U14	1820-0577	1	IC:DIGITAL TTL HEX INVERTER	01295	SN22729
A1U15	1820-0661	1	IC:TTL QUAD 2-INPT OR GATE (Preferred part)	28480	SN-7432N
A1U16	1820-0380	1	IC:TTL 4-WIDE INVERT GATE	01295	SN4488
A1U17	1820-0351	1	IC:DIGITAL DTL TRIPLE 3-INPT NAND GATE	28480	1820-0351
A1U18	1820-0581	2	IC:DIGITAL ECL DUAL AC-COUPLED J-K/F-F	28480	1820-0581
A1U19	1820-0581		IC:DIGITAL ECL DUAL AC-COUPLED J-K/F-F	28480	1820-0581
A1U20	1820-0511		IC:TTL QUAD 2-INPT & GATE	01295	SN20572
A1U21	1820-0077	2	IC:TTL DUAL D FF (LATCH)	01295	SN4354
A1U22	1820-0077		IC:TTL DUAL D FF (LATCH)	01295	SN4354
A1U23	1820-0072	1	INTEGRATED CIRCUIT:TTL	01295	SN4347
A1U24	1820-0174		INTEGRATED CIRCUIT:TTL HEX INVERTER	01295	SN8199
A1U25	1820-0054		IC:TTL QUAD 2-INPUT NAND GATE	01295	SN4342
A1U26	1820-0275	1	INTEGRATED CIRCUIT:DIGITAL	04713	SC 7023PK
A1U27	1820-0282	1	IC:TTL 2-INPT OR GATE	01295	SN13603
A1XU8,13	1200-0474		SOCKET:IC	28480	1200-0474
J1	1250-0001	3	CONNECTOR:BNC	02660	
J2	1250-0001		CONNECTOR:BNC	02660	
J3	1250-0001		CONNECTOR:BNC	02660	
R1	2100-3075	2	R:VAR COMP 1K OHM 20% 1/4W	28480	2100-3075
R2	2100-3075		R:VAR COMP 1K OHM 20% 1/4W	28480	2100-3075
S1	3101-1599	2	SWITCH:SLIDE DP3T 0.5A 125V AC/DC	28480	3101-1599
S2	3100-2920	1	SWITCH:ROTARY	28480	3100-2920
S3	3100-2921	1	SWITCH:ROTARY	28480	3100-2921
S4	3101-1159	1	SWITCH:PUSHBUTTON SPDT	82389	10S-1051
S5	3101-1327		SWITCH:SLIDE DP3T 0.5A 125V AC/DC	79727	G128S-0006
W1	05302-60003	1	CABLE ASSY:MAIN INCLUDES S2, S3	28480	05302-60003
W2	05302-60004	1	CABLE ASSY:SENSITIVITY CHAN A (R1)5-1/2"LG	28480	05302-60004
W3	05302-60005	1	CABLE ASSY:50 MHZ, (J1), 5-1/2" LONG	28480	05302-60005
			CHASSIS & MISCELLANEOUS PARTS		
MP1	0370-1005	2	KNOB:JADE GREY	28480	0370-1005
MP2	0370-1099	2	KNOB:JADE GREY	28480	0370-1099
MP3	05300-40003	4	SUPPORT:BOARD	28480	05300-40003
MP4	05300-40004	4	GUIDE:SLIDE	28480	05300-40004
MP5	05301-20005	1	STAND:TILT	28480	05301-20005
MP6	5040-7032	2	FOOT: REAR	28480	5040-7032
MP7	05300-20010	1	CASE: ALUMINUM, CAST	28480	05300-20010
MP8	05302-00001	1	PANEL:FRONT	28480	05302-00001
MP9	05302-00002	1	BRACKET:FRONT	28480	05302-00002
MP10	05302-00004	1	PANEL:REAR	28480	05302-00004
MP11	05300-80004	1	DUST COVER	28480	05300-80004
	8120-0026	1	CABLE:RF 100 OHM 13"LONG, USED IN MAKING W2 AND W3	28480	8120-0026
	8120-0097	1	CABLE:2-CONDUCTOR SHIELDED 2X#26AWG, 12" LONG, USED IN MAKING PART OF W1	28480	8120-0097
MP12	0624-0208	8	SCREW:SELF-TAPPING, CAD-PLATE POSI-DRIV 6/32 X 1/2"	28480	0624-0208
MP13	2360-0111	2	SCREW:PAN HEAD SS POSIDRIV 6/32" x 3/16"		
MP14	3050-0391	2	WASHER:BRASS .385 I.D.; .625 O.D.; .015 THK; NI PLATE		

See introduction to this section for ordering information

Table 9B-6-2. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
	NO M/F DESCRIPTION FOR THIS MFG NUMBER		
01121	ALLEN BRADLEY CO.	MILWAUKEE, WIS.	53204
01295	TEXAS INSTRUMENTS INC. SEMICONDUCTOR COMPONENTS DIV.	DALLAS, TEX.	75231
02660	AMPHENOL CORP.	BROADVIEW, ILL.	60153
04713	MOTOROLA SEMICONDUCTOR PROD. INC.	PHOENIX, ARIZ.	85008
07263	FAIRCHILD CAMERA & INST. CORP. SEMICONDUCTOR DIV.	MOUNTAIN VIEW, CALIF.	94040
19701	ELECTRA/MIDLAND CORP.	MINERAL WELLS, TEX.	76067
28480	HEWLETT-PACKARD COMPANY	PALO ALTO, CALIF.	94304
29604	STACKPOLE COMPONENTS CO.	RALEIGH, N.C.	27610
56289	SPRAGUE ELECTRIC CO.	N. ADAMS, MASS.	01247
72136	ELECTRO MOTIVE MFG. CO. INC.	WILLIMANTIC, CONN.	06226
72982	ERIE TECHNOLOGICAL PROD. INC.	ERIE, PA.	16512
74868	AMPHENOL CORP. RF DIV.	DANBURY, CONN.	06810
79727	CONTINENTAL-WIRT ELECTRONICS CORP.	PHILADELPHIA, PA.	19144
80131	ELECTRONIC INDUSTRIES ASSOCIATION	WASHINGTON, D.C.	20006
82389	SWITCHCRAFT INC.	CHICAGO, ILL.	60630

Figure 9B-6-1. Mechanical Parts Location



SECTION IX B

5302A UNIVERSAL COUNTER
SUBSECTION VII
MANUAL CHANGES AND OPTIONS

9B-7-1. MANUAL CHANGES

9B-7-2. Section IX B applies directly to Models 5302A Universal Counters having serial prefix number 1112A.

9B-7-3. NEWER INSTRUMENTS

9B-7-4. As changes are made, newer instruments may have serial prefix numbers not listed in Section IX B. The manuals for these instruments will be supplied with "manual changes" sheets containing the required information; replace the affected pages with the "replacement manual changes" pages. Contact the nearest Hewlett-Packard Sales and Service office for information if this sheet is missing.

9B-7-5. OLDER INSTRUMENTS

9B-7-6. No older instruments at time of printing.

9B-7-7. OPTIONS

9B-7-8. No options at time of printing.

SECTION IX B

5302A 50 MHz UNIVERSAL COUNTER
SUBSECTION VIII
CIRCUIT DIAGRAMS

9B-8-1. GENERAL

9B-8-2. Subsection VIII contains:

a. Schematic diagram notes contained in Section VIII of the 5300A.

b. Instrument interconnection pin list of signals listing where they originate and where they go.

c. Component locators and circuit diagrams of assemblies.

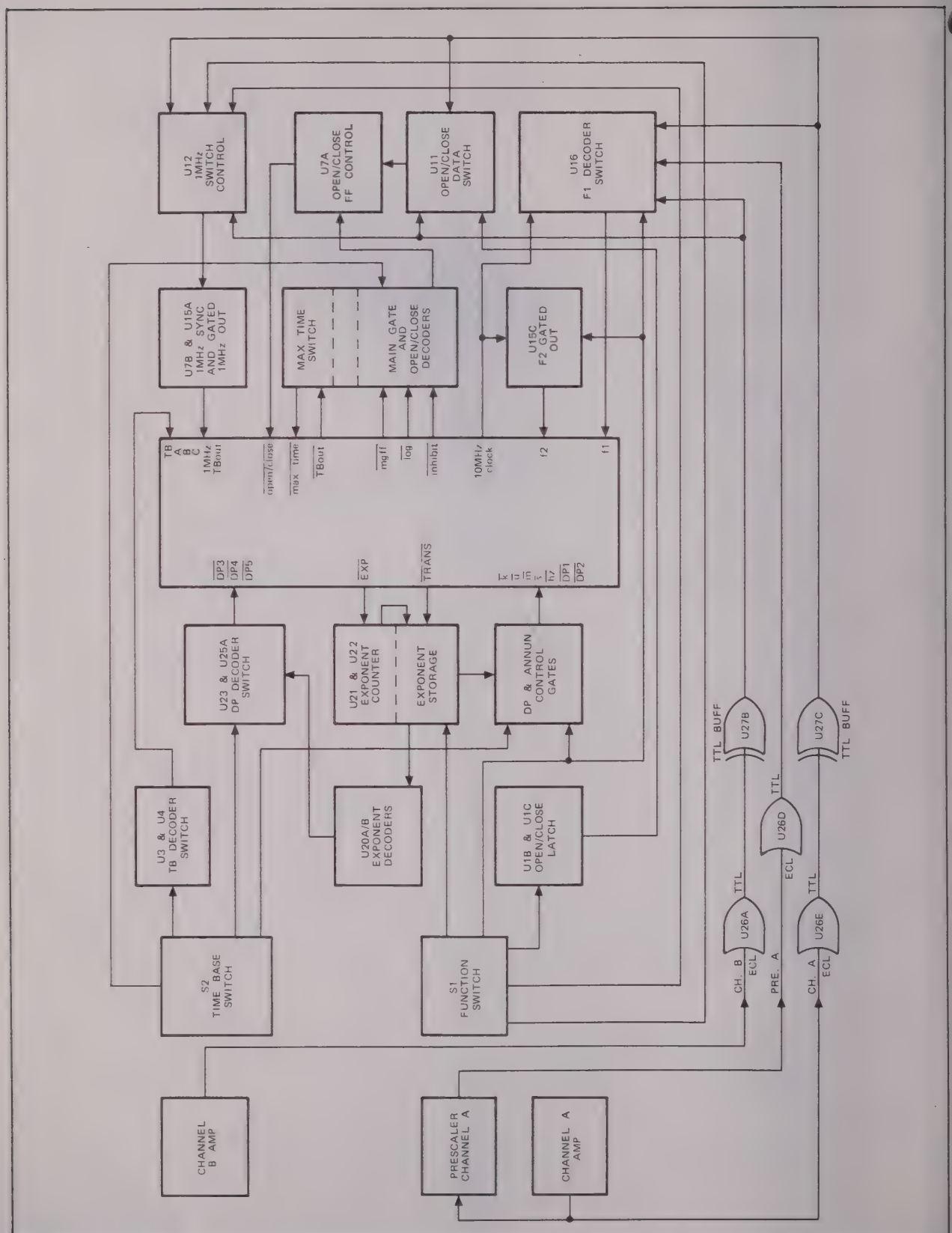
Table 9B-8-1. Instrument Interconnection List

PIN NO.	SIGNAL NAME	DESCRIPTION
1	+5 V	Input DC from 5300A
2	-5 V	
3	NO CONNECTION	
4	GROUND	Ground
5 *	F1	Signal to be accumulated in the counter after gating by the control circuit.
6	"$\overline{9}$"	Goes low when the counter reaches 9% full scale.
7 *	F2	Input signal to the time base gated by the control circuit.
8	$\overline{\text{INHIBIT}}$	High during the measurement cycle, low during the display cycle.
9 *	$\overline{\text{OPEN}}$	Low signal forces the main gate flip-flop to the open position.
10 *	$\overline{\text{CLOSE}}$	Low signal forces the main gate flip-flop to the close position.
11	$\overline{\text{LOG}}$	Logarithmic output pulse train from time base triggers main gate flip-flop on rising edge.
12	$\overline{\text{MGFF}}$	Main gate flip-flop signal is low when gate is open.
13	$\overline{\text{EXPONENT}}$	Inverted log pulses while main gate is open indicates number of auto-ranging steps.
14	NO CONNECTION	
15	RESET	High signal resets all registers.
16	CLOCK	10 MHz reference signal from crystal oscillator
17 *	$\overline{\text{MAX TIME}}$	Low signal enables closing of the gate on next log pulse. Rising edge initiates display cycle.
18	TIME BASE OUTPUT	Output from the time base decade position selected by the time base select code on pins 22, 23, and 24.
19 *	$\overline{\text{PRINT}}$	Low signal provides print command to rear panel connector.
20	$\overline{\text{TRANSFER}}$	Low signal transfers data to display. High signal stores data.
21 *	1 MHz TIME BASE INPUT	Input direct from plug-on bypasses control circuit.
22 *	TIME BASE SELECT A	Time base select code A, B, and C selects the time base division factor of the signal at the time base output at pin 18.
23 *	TIME BASE SELECT B	
24 *	TIME BASE SELECT C	
25 ← 50 ←	+22 V Interconnection	Full wave rectified voltage from the power transformer secondary. Provides power to charge the battery pack. If no battery pack is used, pin 25 is connected via the plug-on to pin 50 (DC-IN).
26	+17 V	
27 *	$\overline{\text{Hz}}$	Pins 27 through 31 provide the drive to the annunciator lights on the front panel. A low signal lights the corresponding indicator.
28 *	$\overline{\text{M}}$	
29 *	$\overline{\text{S}}$	
30 *	$\overline{\text{K}}$	
31 *	$\overline{\mu}$	
32	$\overline{\text{MANUAL RESET}}$	Low signal from front panel pushbutton switch or rear panel input clears the system to zero.
33 *	$\overline{\text{DP1}}$	Low signal activates decimal point 1.

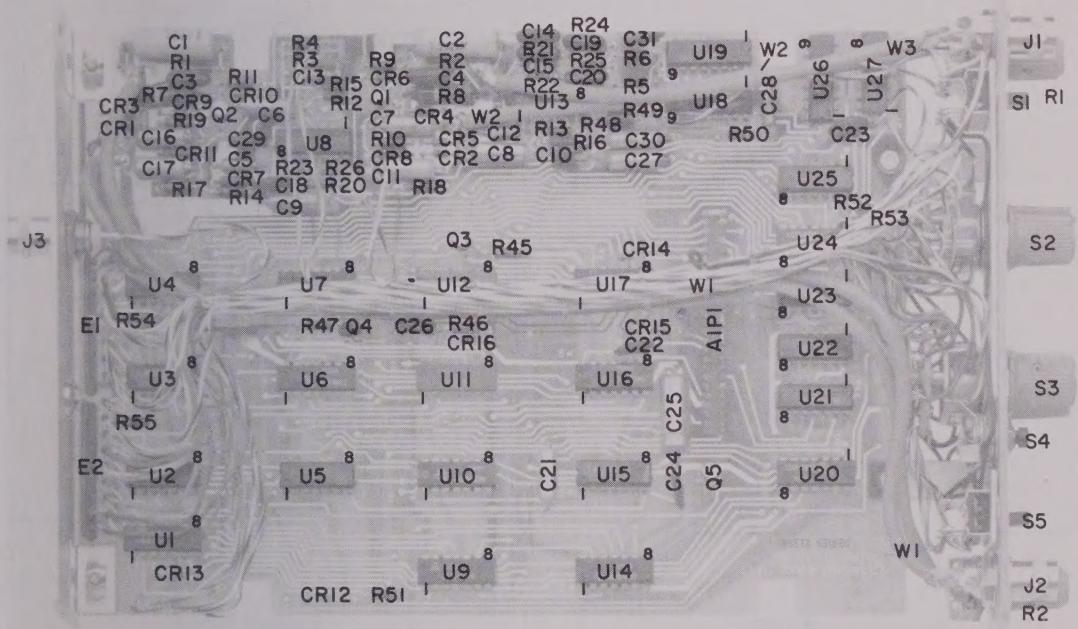
Table 9B-8-1. Instrument Interconnection List (Cont'd)

PIN NO.	SIGNAL NAME	DESCRIPTION
34 *	$\overline{DP2}$	Low signal activates decimal point 2.
35	RIGHT/LEFT	Code indicating half character which is being addressed. High when right-hand half of character is displayed.
36	DIGIT ADDRESS X	Digit address code X, Y, Z from the display scanner indicates a digit being displayed.
37	DIGIT SELECT X	
38	DIGIT ADDRESS Y	
39	DIGIT SELECT Y	Digit select code X, Y, Z is the corresponding code which selects the digit at the output of the counter. If the main-frame counter is displayed directly the corresponding lines of the digit address code and the digit select code are con-connected together.
40	DIGIT ADDRESS Z	
41	NO CONNECTION	
42	NO CONNECTION	
43	NO CONNECTION	
44	NO CONNECTION	
45	NO CONNECTION	
46 *	$\overline{DP3}$	Low signal activates decimal point 3.
47 *	$\overline{DP4}$	Low signal activates decimal point 4.
48 *	$\overline{DP5}$	Low signal activates decimal point 5.
49	NO CONNECTION	Ground
50	DC IN Interconnection	DC power to power supply from battery pack or from 22 volt input power from pin 25.
25		

Part of Figure 9B-8-1. A1 50 MHz Assembly Block Diagram



Part of Figure 9B-8-1. A1 Component Locator



R27, 28, 30, 31, 33, THRU R44 LOCATED IN E1 AND E2

Part of Figure 9B-8-1. A1 50 MHz Board Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS.
3. ASTERISK (*) INDICATES FACTORY SELECTED VALUE. TYPICAL VALUE SHOWN.

REFERENCE DESIGNATIONS

NO PREFIX	A1
	C1-31
	CR1-16
	Q1-5
J1-3	
	P1
R1,2	R1-28,30, 31,33-51
S1-5	
	U1-27

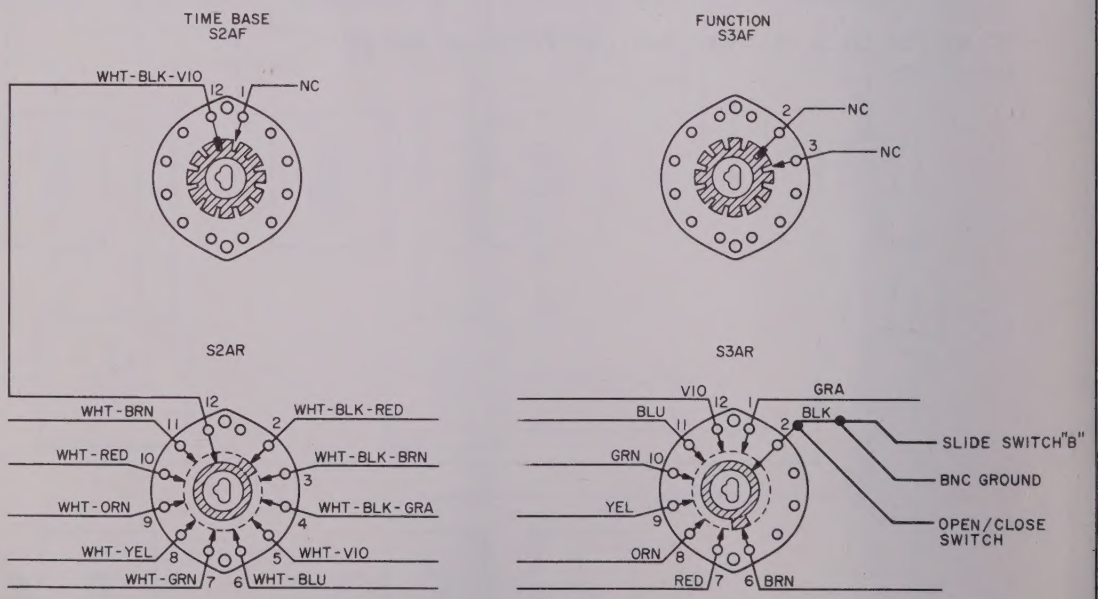
R29,32 NOT ASSIGNED.

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
CR1,2,3,5,12, 14,15,16	1901-0040
CR4,6,9,10	1901-0044
CR7	1902-0064
CR8,11	1902-3203
CR13	1910-0034
Q1,2	1855-0306
Q3,5	1854-0009
Q4	1853-0015
U1	1820-0307
U2	1820-0274
U3,4	1820-0441
U5,25	1820-0054
U6,20	1820-0511
U7	1820-0281

TABLE OF ACTIVE COMPONENTS

REFERENCE DESIGNATIONS	HP PART NUMBERS
U8,13	1820-0253
U9	1820-0094
U10,24	1820-0174
U11	1820-0084
U12	1820-0590
U14	1820-0577
U15	1820-0661
U16	1820-0380
U17	1820-0351
U18,19	1820-0581
U21,22	1820-0077
U23	1820-0072
U26	1820-0275
U27	1820-0282



1. TIME BASE SWITCH (S2) SHOWN IN AUTO POSITION. DIRECTION OF TRAVEL IS CW.
2. FUNCTION SWITCH SHOWN IN FREQ. "A" POSITION. DIRECTION OF TRAVEL IS CW.

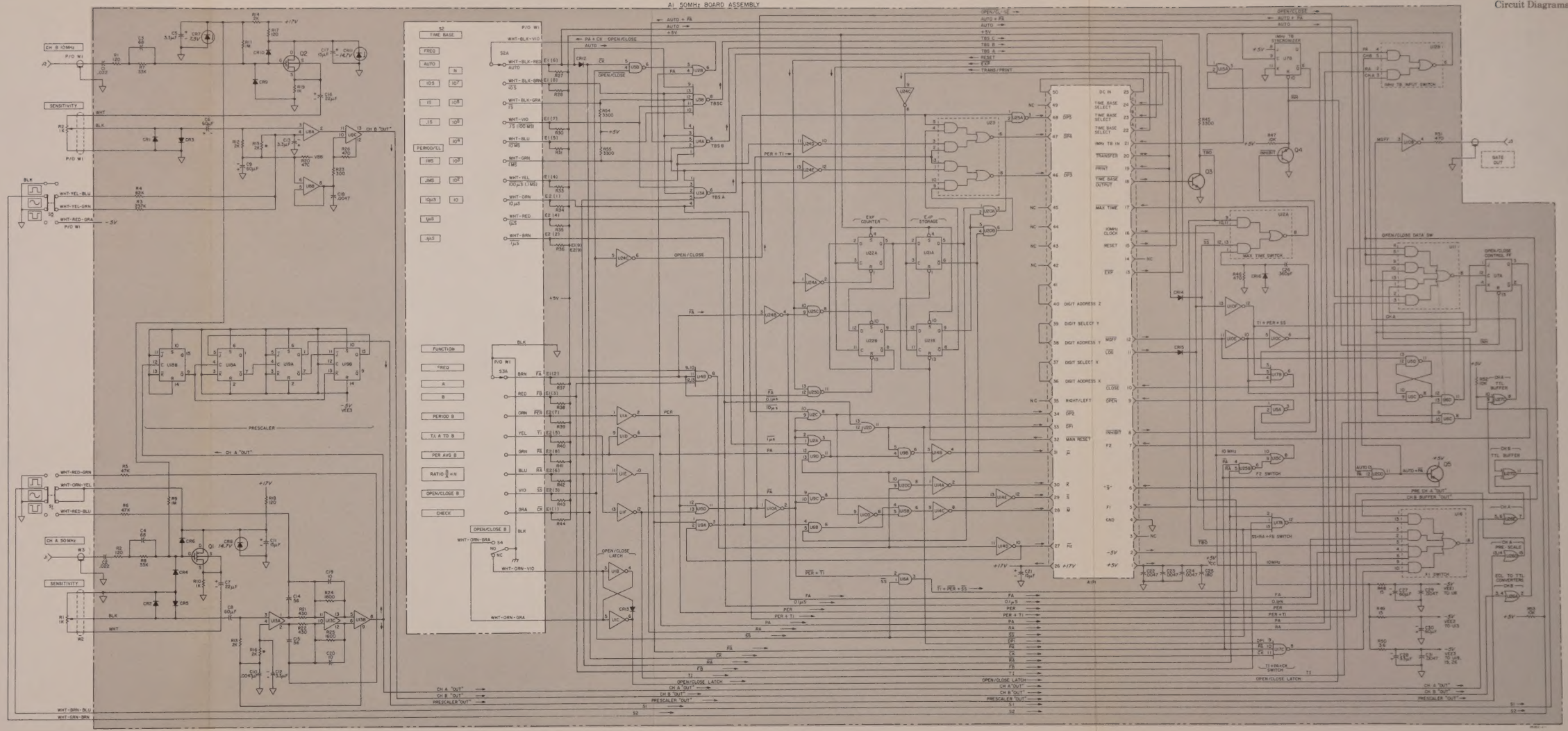


Figure 9B-8-1
A1 50 MHz Board Assembly
9B-8-7

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